Gas Journal, Sept. 23, 1919. Registered as a Newspaper.

DEC 23 1919 CHEMICAL LIBRARY

GAS JOURNAL

LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CXLVII. No. 2941.] LONDON, SEPT. 23, 1919. [71ST YEAR. PRICE 8d.

OXIDE OF IRON
SPENT OXIDE

GAS PURIFICATION AND CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C. 2.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 LONDON WALL.

PUMPING ENGINES
All Types for ACID, &c.
CAST-IRON OR STEEL TANKS
Any Capacity.
CHEMICAL PLANT.
Roofs and Girders. Structural Work.
SULPHATE OF AMMONIA PLANT
Air and Gas Compressors.
MIXERS.
TAR STILLS AND CONDENSERS.
W. NEILL & SON, LD.
Engineers, Iron & Brass Founders,
ST. HELENS JUNCTION.
Telegrams: 'NEILL, ST. HELENS.' Telephone No. 20.

PURIFYING MATERIAL
"Brownox-de-Luxe."
Unqualified Satisfaction given where used.
SPENT OXIDE PURCHASED
J. BROWN & CO., Ltd.
Savile Town, DEWSBURY.

TORBAY
JOINT STOPPING
FREE FROM LEAD.
The TORBAY PAINT CO.,
26/28, Billiter St., LONDON, E.C. 3.
39/41, Old Hall St., LIVERPOOL.

"BLUEBELL"
SILICA RETORTS
(95% SILICA)
John G. Stein & Co., Ltd.,
Castlecary, SCOTLAND.

Makers of
GASHOLDERS,
TANKS (C.I. or Steel),
PURIFIERS,
WASHERS,
ROOFS,
&c.
ASHMORE, BENSON, PEASE & CO., LTD.,
STOCKTON-ON-TEES.
Complete
GAS WORKS
London Office:
39, Victoria Street, Westminster, S.W.
Telegrams: "GASHOLDER."

W. & B. COWAN
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),
LONDON. MANCHESTER. EDINBURGH. GLASGOW.
SYDNEY. MELBOURNE. BRISBANE. WELLINGTON, N.Z.
(See Advertisement on page III. of Wrapper.)

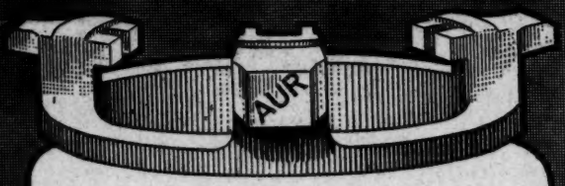
JAMES McKELVIE & CO.
Coal Owners,
Gas and Steam Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
ESTABLISHED 1840.

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

"Extremely Accurate and Well Made"
aptly describes George Glover's Dry Gas Meter. Giving "correct" registration at all outputs and at varying pressures, it will be found satisfactory under the most trying conditions. Every meter leaving their works, irrespective of size—and they build up to 3000 lights—is regulated and tested for soundness at 12-in. pressure, and for registration not only at the ½-in. pressure prescribed by the "Sales of Gas Act," but at 3-in. pressure with full outlet capacity so as to prevent slow registration even when the Meter is overworked. Since 1861 the
George Glover Dry Meter
has gained the highest awards at the principal International Exhibitions and to-day represents the ideal gas recorder.
PARTICULARS AND PRICES ON APPLICATION.
GEORGE GLOVER & CO LTD
RANELAGH WORKS. CHELSEA. LONDON. S W 3.

RITCHIE C.I. PIPES FOR GAS & WATER. MIDDLESBROUGH.

& COAL WASHER. MANCHESTER.



THE
WELSBACH
LIGHT CO., LTD.

Welsbach House,
KING'S CROSS,
London, W.C.1

There Are No Better Mantles Made

The Welsbach Light Co., Ltd.

is an ALL British Company

The Welsbach Factory produces the largest number of Mantles of all Factories in the United Kingdom.

B DONKIN D

A TIGHT GAS VALVE FOR HIGH-PRESSURE MAINS.

DOUBLE FACED GAS VALVES

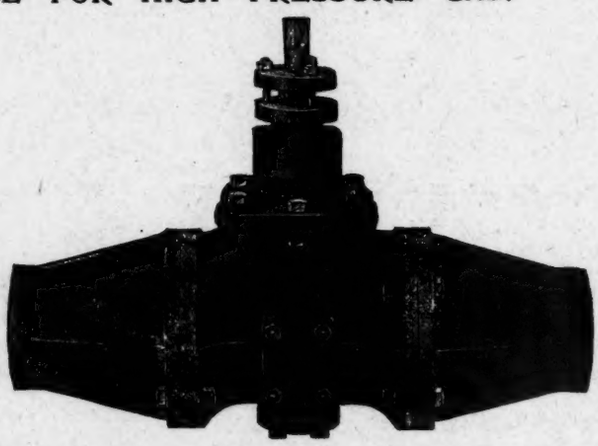
(PATENT NO. 12734/06).

SPECIALLY SUITABLE FOR HIGH PRESSURE GAS.

We have specially designed these valves for use in connection with high-pressure gas, either with screwed ends, flanged ends, or with separate sockets for Mannesmann Steel Tube Rigid Joint. They have all the advantages of the rack and pinion or worm and rack valve—that is to say, they have the scraping action of the doors over the faces, as the two faces are separate and kept out to their work by springs, so that they will not have the disadvantage of the usual double faced solid body type valve which tends to jamb after it has been at work some time.

Very much thought and care have been given to the design of these valves and very rigid air tests have been made upon them for tightness.

PRICES ON APPLICATION.



This type of Valve has been adopted by the Birmingham Corporation and many other Works for their High-Pressure Mains.

LARGE NUMBERS SUPPLIED.

Head Offices & Works:

THE BRYAN DONKIN CO., LTD., CHESTERFIELD.

London Office: 3, VICTORIA STREET, WESTMINSTER, S.W. 1.

Chesterfield Telephone No. 84.
London Telephone No. 5858 Victoria.

Chesterfield Telegrams, "Donkin Chesterfield."
London Telegrams, "Donkin Vic. London."

B CHESTERFIELD D

GAS JOURNAL

LIGHT ✂ HEAT ✂ POWER ✂ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CXLVII., No. 2941.] TUESDAY, SEPTEMBER 23, 1919. [71ST YEAR.

EDITORIAL NOTES.

Gas Reformation and the Next Parliamentary Session.

PARLIAMENT will soon be meeting again; and momentous matters will have to be dealt with. Ministers are returning from brief holidays; and there is great activity Westminster way upon the questions which will be under serious discussion before many more weeks have passed. We may claim that, from both the points of view of justice and the indispensability of the gas industry to the country, its affairs, being as they are in critical and debilitating state, should have the very earliest possible attention. The people of the country are (to their loss until Parliament makes the essential readjustment of terms to current circumstances) heavy investors in the industry; and the industry is a servant of the country with ramifications of duty and influence of almost indefinable extent. Nevertheless its responsible men are, as yet, very much in the dark as to what is likely to happen in regard to the revision of the statutory enactment applying to gas undertakings; and everywhere a longing is experienced for the present uncertainty to be lifted. To this uncertainty, and in some instances to professional interest, are due the differences in advice as to the line of action that should be taken in regard to collective or individual movement in approaching Parliament. The two general matters which are of universal importance at the present time—financial revision, and the recommendations of the Board of Fuel Research—are not ones on which, in respect of parliamentary application, even Parliamentary Agents or Consulting Engineers can rightly advise, because they cannot know what may or will be the plans of the Board of Trade, nor even whether their proposals, when matured, will meet with total endorsement by the Cabinet. The administrators of gas undertakings should, therefore, be very chary as to taking action upon advice from quarters that are not, in this particular regard, better informed than they are themselves.

Throughout the piece, we have had a consistent preference for consolidated movement, through the Board of Trade acting in consultation with the National Gas Council, to secure legislation which will re-establish the gas industry, and enable it to make the best use of its great potentialities. Last week the suggestion was made that, while in this matter the industry should move as one, no harm would be done in considering what would be the right course to take in the event of no definite information being given well before the day that notices have to be lodged of the promotion of Private Bills. To-day, we would suggest (and we do not do this in any vacillating spirit) that beyond consideration movement should not be made, although nothing definite has been publicly stated as to what is likely to be done. On this point, it will be well appreciated that the National Gas Council are not at liberty to publish anything relating to matters in parliamentary embryo, until the full round of Government endorsement has been given. To do so would be a highly impolitic and dangerous proceeding. However, when we look back over our article of last week, under the heading of "Time Presses," and to the criticism of certain passages in the minutes of the Central Executive Board of the Council—particularly the statement that, "before considering the promotion of Bills, "of their own, which it was understood to be the intention "of certain undertakings that had been specially hard hit, "the Chairman strongly advised them to give the authori- "ties a chance of proving their good intentions"—a fresh consideration arises; and it is one that will perhaps, when pointed out, supplant some of the prevailing uncertainty by a measure of confidence. The advice in the quoted passage is that of the President of the Council; but the President of the Council and the Governor of the Gas Light and Coke Company are one and the same individual. And the fact (this is what we desire to emphasize) that there is no indication of preparations for the promotion of a Special Bill by the Company shows that the Governor is at all events satisfied with the course matters are taking in respect of dealing with the difficulties of the industry on a joint and universal basis. He is answerable to a body of gas stockholders far more numerous than is possessed by any other gas undertaking in the United Kingdom.

Things are far different now from what they were two years ago. The case of the industry—financially, technically, and commercially—has been made much stronger by the march of events and the more definite shaping and consolidation of conditions. There is no uncertainty to-day about the metamorphosis in conditions being of a permanent character. The report of the Board of Fuel Research upon the reference to them by the Board of Trade also extends largely, and in most important measure, the ground upon which to work. These are independently and collectively essentially matters that are best dealt with in a General Bill, and not for a repetition of the chaotic course of events that ended so disastrously for statutory gas undertakings less than two years ago. The best work on which gas administrators, officials, and gas share and stock holders can immediately exercise themselves is, in anticipation of coming events, to spread information among their members of Parliament as to the position in which the industry has been projected by working under legislation that belongs to the conditions of other days, but has no congruity with the circumstances of the present. Help from any and every quarter will be valuable. The industry will not get through without some opposition in the House of Commons; but right is on its side.

Revision of Dividend upon Existing Gas Capital.

THE question of what dividend upon existing ordinary capital the gas industry should ask for in the revision of its financial conditions, is admittedly a highly polemical one; and it is not a matter upon which we would offhand express any conclusive opinion, but would rather remain in the position of being able, if thought fit, to accept or abide by any decision arrived at by the expert financiers of the industry, whose acuity in these special matters will no doubt keep us right. There is no harm, however, in discussing the subject. Last week, attention was called in our editorial columns to the fact that the Central Executive Board of the National Gas Council are of opinion that the industry is entitled to ask for legislation that will secure for share and stock holders a pre-war dividend; and there was indication that we regarded such an idea as, at any rate, the rock-bottom minimum, while fairness demanded better consideration—seeing that economic conditions have altogether changed, that money has not the same value as formerly, and that the income-tax is likely to remain high for some years to come.

The question is a most interesting one for discussion; and it may be enlarged upon not only from the standpoint of the reduced value of money, but from others. At one time in parliamentary discussions, it was rightly argued—the

economic state being then subject to no violent fluctuations —that the standard price of gas under the sliding-scale was inviolable. But this argument has been pushed completely aside by the creation of totally new economic conditions. We are on a new basis now; and for the gas industry everything is going into the melting-pot—in fact, is already there. If the standard price is subject to change in order to cause it to conform to the new conditions, why not the dividend? There is nothing sacred about the standard dividend nor the pre-war dividend with the conditions a total wreck on which they were founded. When we speak of the lower purchasing power of the money derived as dividends to-day in comparison with ante-war times, and suggest that very careful consideration should be given to the question of the right dividend to ask for on existing capital, we are not unmindful of the fact that upon pre-war Government stocks there is no suggestion that higher dividends should be paid. But here again we have differences. Behind these stocks there is Government security, and most of them were bought below par. Behind gas stocks, there is the security of a trading industry, which has to meet the shocks provided by the purchasing and selling markets, by labour, by competition, by trade variations, and even atmospherical conditions insist upon creating disturbances in the volume and profitableness of the busines. Moreover, upon much of the stock a premium has been paid—on the old conditions; and the premium causes the dividend to become more attenuated still when spread over the total investment. Now what is the result? The suggestion of the Central Executive Committee is to work to secure the pre-war dividend. Will the securing of the pre-war dividend restore the pre-war market value of the stocks? Of course, it will not do so. People are not going to pay the old market prices for a dividend that has only half its former purchasing power. The restoration of the pre-war dividend would send up the market values of shares and stocks from their present sad position; but there would be a stoppage a good bit short of the level of the old market values. In the work of rehabilitating the financial conditions of the industry, we should not take too narrow a measure of what should be done, but there should be some attempt to restore as far as possible the position from all points of view, with the intention of bringing the conditions as closely as maybe into harmony with the facts of the current and the probable prospective situation.

There is another point the value of which cannot be assessed, but it should have a place in the argument for considerate treatment. What outlook had gas share and stock holders in the first half of 1914? It was good; and sliding-scale companies had excellent hope of lower prices and higher dividends. Then it was seen that the gas-heating business—domestic and industrial—was expanding on all hands. Then came the war, which has been directional in the matter of several manufacturing economies. But we are not going to concede that had there been no war there would have been no progress, and that we should not have learned how to put more B.Th.U. per ton of coal carbonized into the gas distributing mains. To suggest that there would have been sterilization would be an insult to the intelligence of the industry, and to the ability of its research and technical workers. Assuming then that we are back at 1914, with the then rates of dividend and the then market values for stocks and shares, have we no right to carry our assumption to the extent of saying that the technical and commercial work combined would have secured for the consumers reduced prices for gas, and for the ordinary share and stock holders under the sliding-scale higher dividends and higher market values? We think this a fair assumption; but it is impossible to assess the value other than hypothetically. Nevertheless, as we say, in the argument for considerate treatment, this is certainly an aspect of the position for which credit should be taken.

There is a further point. New capital will require a higher dividend; it is not going to be satisfied with a pre-war dividend on capital purchased (say) at par. It will look for a dividend and conditions which will not only maintain, but will supply a fair prospect of appreciating, the market value under the new conditions. What does this mean? It means that all new capital in the gas industry would be much better favoured both in regard to dividend and market values than the existing capital. It means, too, that the market values of the existing capital will be the subject of further depreciation, owing to the new capital supplying the better market. Why should all the old investors in the gas industry suffer loss? Why should they be worse off than the new investors? Why should they be worse off than investors in other lines of business? Why should their financing of an essential industry bring upon them unmerited punishment? We boasted once of the security that statutory control and power gave to the gas industry. Terms were exacted from the gas industry in exchange for this so-called "security." What has happened to the security so far as the existing gas capital is concerned? It is for Parliament to do the just thing? And to do it would not entail a heavy additional charge per 1000 c.ft. upon the gas consumers. Even if it did, justice and right have their claims.

Protection, Energy Concentration, and Elasticity.

A LITTLE more than five weeks hence, we shall be at the end of October, when the protection over the standards of supply of the gas industry will again have expired, and will need renewal. In the letter which the Board of Trade circulated on June 30, and which was reproduced in our columns on July 8 [p. 72], it was stated that "the position would be "very carefully reviewed by the Board before the end of "October." The coal position was bad at the time of the last renewal. It is infinitely worse now—what with coal miners' strikes and the fearful decline of output by some millions of tons in the course of a few weeks. What has been lost cannot, with the shorter hours of working, now be made up, however much energy is shown by the miners, before the winter season sets in. Not only output, but (speaking generally of the country) stocks are short. Good persevering work in the mines may very materially ameliorate the situation. But it cannot compensate for what has happened; and so the authorities must continue to help the gas industry, and thereby permit it to help them by making the best use of the coal carbonized. Every month that passes adds additional confirmation to previous experience, that the highest efficiency the gas industry can derive from coal is to be obtained not by limitation, but by elasticity. And so, while the Board will no doubt feel that in the position of coal supplies and stocks they have no alternative but to continue the protection, they can do so with the easy conscience that they have behind them the endorsement of the Board of Fuel Research, and vast experience.

The gas industry is day by day losing largely and in several ways through the uncertainty that obsesses it; and we want to see as an accomplished fact that new "era" of which the Committee of the Privy Council for Scientific and Industrial Research spoke when they said in their recently issued report: "The work of the Board of Fuel Research on "Gas Standards, undertaken at the request of the Board of "Trade, seems likely to usher in a new era in the relations "of the consumers and the gas companies at the moment "when the need for economy and efficiency in gas practice "is more insistent than it has ever been since the industry "was founded." "The need for economy and efficiency in "gas practice!" Means to this end are what the Board of Fuel Research have advised, if certain crippling suggestions in their report are removed or modified. In the letter that Dr. Carpenter published in our columns last week, he makes three plain points; and there are people who think there may be an oblique one somewhere beneath the surface. The three points in the letter are: (1) That the South Metropolitan Gas Company fully recognize that the Board of Fuel Research propose that each gas undertaking shall have liberty to select a calorific value for the gas it supplies which conforms best to its own conditions and requirements; (2) that there are some gas people who have partially forgotten the art of gas making; and (3) that if we think in terms of energy instead of gases, we shall soon be drifting-back to a belief in supplying energy in concentrated form instead of the more diffuse form which has become the practice. While agreeing that the question of the calorific value to be supplied is, under the report, a matter for individual selection, the principles and policy and attendant conditions (which would largely undermine the liberty that the Board consider it only right should be conferred) are matters for collective consideration and action. Individual action would then follow.

We are quite persuaded that there are not only some people who have during the war forgotten the art of gas-making, but some who have become so entrenched in system that they have forgotten that the art of gas making includes the economical use of coal, and progress in placing

at the command of the public the largest available amount of heat energy in gaseous form from the coal. The greater the concentration of the heat energy supplied in gaseous form, the greater the limitation in production, and therefore the greater the quantity of coal required per given output of heat energy, and thus the heavier the expenditure upon coal. Liberty and elasticity do not go well with a too great concentration of heat energy in the gas. Gas engineers are now talking of 8, 9, and 10 million B.Th.U. in the gas for sale per ton of coal, though there will be somewhat less coke for disposal. But the former is the handier and more acceptable fuel. Not only is there a greater number of B.Th.U. for sale in gaseous form per ton of coal as departure is made from a high concentration of heat energy per cubic foot, but certain of the secondary products (where steaming is the practice) are improved either quantitatively or qualitatively, the labour employed is less per 1000 c.ft. or—shall we say?—per 100,000 B.Th.U.; and through the greater efficiency of the gas-making process, the conservation of coal is served. The gas industry is not troubling itself so much about the supply of energy in concentrated form as concentrating upon the most economical supply of energy per ton of coal carbonized. It does not find that, per volume of gas-air mixture at the point of use, there is any material difference in B.Th.U. whether the gas contains a large concentration of heat energy or a less concentration. But it does find that the latter has virtues in use which the former has not, and that it is less susceptible to changes, which is an advantage to the consumer.

It is noted that large installations of vertical retorts with the view to steaming, and obtaining more heat energy in gaseous form per ton of coal, are being put in at Glasgow, Manchester, Birmingham, Leicester, and elsewhere—some as extensions, others as altogether new work. These are not being made because the technical men associated with the undertakings are all wrong in regard to this question of energy concentration, and the technical staff of the South Metropolitan Company the only right one in their conclusions. It was Sir Arthur Duckham who was not long since writing in our columns: "We have been taught "to think imperially; the gas industry must now be taught "to think thermally." It was Dr. Carpenter who, in our issue of June 17, writing primarily on the subject of sulphate of ammonia, made a remark which will apply to other subjects: "We want to get as many of the vexatious "controls which are hampering industry in all directions "removed instead of bolstering them up." It is the South Metropolitan Gas Company who are proposing to promote a Bill in the next session of Parliament accepting limitations and control which have never before been imposed on the industry!

The King's Appeal.

THROUGHOUT the gas industry, there will be very practical sympathy with the King's Appeal for the employment of men disabled in the war, and whose self-sacrifice has helped us in so literal a sense to save the Empire. The gas industry with other industries fully recognizes what the country owes to these men; it acknowledges its "solemn obli- "gation;" and it will do what it can. The character of the operations on gas-works imposes limitations which must be observed; but the South Metropolitan Gas Company have set a good example in the employment of disabled men in the meter-repairing department, though opposed by one of the trade unions concerned. Here "solemn obligation" took precedence of trade union unfriendliness. The clerical departments of gas undertakings may also offer opportunities, where there are vacancies to be filled. Every gas undertaking, however, is in honour bound to take back into their service those men who went to the war, and have returned or will return, and were promised that their places should be kept open for them. The industry has also its own war-disabled men. Where there is any available work the industry can be relied upon to give preference to ex-service men; and when we speak here of the "industry," the manufacturers of gas plant and gas-consuming appliances are included. It is a matter for great regret in the circumstances that in an industry such as gas-supply, the work of which involves so much man power, it is being kept from expansion, and so from giving extra employment, by financial and other restrictive conditions under which it is working, and from which Parliament could give permanent relief. When the industry obtains relief in respect of these, then it can press forward with greater freedom, and secure an extension of business which will mean an enlargement of employment. However, we hope to see many names in the industry on the National Roll of Patriotic Employers, and, on the correspondence paper of gas undertakings and of the makers of gas plant and appliances, the device which the appearance of their names on the Roll will entitle them to use.

The Beilby Report.

An article by an "Engineer" on the "Meaning of the Beilby Report" appears in this issue. It is well worth careful attention by all readers. There will not be agreement with every point he makes—particularly regarding his suggestion as to how the South Metropolitan Gas Company could make it clear to the authorities that they do not wish their acquiescence to be taken as a precedent. Some comments on the article will appear in next week's issue.

The Largest Vertical Retort Contract.

Glasgow has distinguished itself by giving out, in a single contract, an order to the Woodall-Duckham Company, Limited, for an installation of continuous vertical retorts, the cost of which will probably somewhat exceed half-a-million sterling. A few particulars appear on a later page.

A Campaign against Fuel Waste.

The high price of coal should work wonders in connection with fuel economy in our industries; and if men like Prof. Bone, Sir Robert Hadfield, Mr. H. James Yates, and Mr. R. J. Sarjant, and others who contributed papers at the meeting of the Iron and Steel Institute last week continue with such ardour their missionary work in this great cause, economies will be realized which will be of permanent advantage to industries, and so to the country at large. It is remarkable that in such a highly developed industry as that of iron and steel production, there should be such lamentable fuel waste as there is through sheer neglect. Inquiries show that the works are few in number at which there obtain proper investigation, control, and data record which would show whether or not losses are proceeding from which economy is recoverable. Prof. Bone gave the iron and steel industry some sage advice; and we cannot imagine that what he says will not bear fruit, accentuated as his appeal is by the pressure of costs to-day, and threatened competition from other countries where labour conditions are better than they are here, and economies exist where there are losses in this country.

Method of Procedure.

Prof. Bone is not an advocate for at this stage (whatever may be done hereafter) expending time over searching for something new. His plan is to commence where we are; for that is the shortest cut to economy. For the works of those he was addressing, he shows how scientific organization and control and co-ordination of plant should be at once taken in hand, with the view of realizing the utmost from surplus blast-furnace gas and coke-oven gas. Concentration of bye-product coke-ovens, blast-furnaces, rolling-mills, and steel works on one site would produce economy by the utilization of the surplus coke-oven and cleaned blast-furnace gases, partly in large internal combustion engines driving dynamos for the generation of electricity. It seems a ludicrous proceeding to use blast-furnace gas under steam-boilers, as many do, with their average efficiency of (say) 55 p.ct., and then employ (with another steep drop in efficiency) the steam in an engine or turbine for generating electrical energy, when, by the cleaning of the gas, and its direct use in a gas-engine driving a dynamo, considerably greater efficiency from the gas can be secured.

Coke and Gas.

The old question of the preference of some steel makers for beehive coke over bye-product coke for crucible steel melting was again raised. Inquiry shows the continuance of the preference. But as Prof. Bone says, this should, in the national economy, be made the subject of scientific inquiry. It is wrong to say there is not sufficient heating power in bye-product coke. Still there is the preference. Perhaps the fault for it lies in the fact that com-

parisons have been made with cokes produced from different coals, whereas true comparison should be made between cokes produced by the two processes from the same coal. This is a matter that requires investigation, as also should be the adherence by many makers to coke where one would have expected that gas would score on the grounds of easy manipulation and uniformity of temperatures and product. Many authorities are persuaded that it is by utilizing fuel gas to the fullest possible extent that progress in fuel economy lies; and it is in this direction that German practice has concentrated its efforts both for heating and power. It is found that the more modern the works in Germany, the more are large gas-engines used. Speaking of gas, it is noticed that Prof. Armstrong was at the meeting, as he was the previous week at Bournemouth; and at both places he had his usual butt at the gas industry. But on this occasion he got into closer harmony with the trend of development by giving an alternative to his former prescription of low-temperature carbonization for the salvation of the industry, by saying that another way for it to achieve success would be by using less coal and employing its coke for the making of gas.

Firm Prices for Castings and Pipes.

A correspondent calls attention to the statement in the paragraph in last week's "JOURNAL," under the above heading, that numerous concerns "have for some time past been quoting fixed prices for pig iron, without any conditional clause whatsoever." The words were quoted *literatim* from the letter of a company of high standing. But that was not the real point of the original paragraph that appeared on Aug. 26. It was that notwithstanding the increase in the cost of pig iron consequent on the rise in the price of coal, the price of castings and pipes was not being advanced. However, our present correspondent says the words quoted above are "absolutely untrue" so far as his firm are concerned. He adds: "We buy pig iron from various sources; and, when the 6s. was put upon coal, we immediately received notices from the various pig-iron manufacturers that the prices at which their contracts had been fixed would be increased by 20s. per ton—the advance to date back to the time that the 6s. was added to the price of coal."

Prices of Gas-Stoves.

Writing of the prices of pig iron, reminds us of a little piece of information, which leads us to think that the makers of gas-stoves and other gas-heated appliances do not consider that there exists that friendly spirit which might be displayed towards them by the gas industry in respect of the difficulties with which they are surrounded in common with the rest of the country, and which means an increase in the prices of their productions which cannot be resisted. If any good result is to be realized from the appointment of a Joint Committee of the National Gas Council and the Society of British Gas Industries, it will only be by discussion and investigation with the fullest amicability present. This is what we gather to be the position: Gas undertakings are now asked to pay considerably higher prices for goods which are essential to the progress of the gas industry; and some of the responsible men of the industry have a feeling that these prices are in excess of what they should be. From a gas undertakings' point of view, the two questions should be: Are the prices excessive? If they are not (being of a character that dams the flow of business), are there any means by which a reduction of costs can be effected, and a lowering of price result?

Views of the Other Side.

If we interpret correctly the position of the gas-stove makers, it might be briefly described in this way: So far as they are aware, they have increased their prices less than anyone else. Notwithstanding this, whenever an advance has been made, it has always been greatly resented by gas undertakings, though they do not appear to show this attitude towards other manufacturers. The gas-stove makers have twice met the Council of the Institution of Gas Engineers regarding the matter of prices; and, in each instance, they believe they have been able to more than prove that the advance has been justified. The last increase on gas-stoves was long delayed; and the makers aver they would have been fully warranted in making it even larger than they did. It has, of course, to be remembered that since this advance was made £1 per ton has been put on pig iron, and, in some instances, 30s. has had to be paid. In addition, there have been further demands from the workpeople, which have had to be met; and a report reaches us that at the present time further demands are being made by every section of workpeople in certain works. In fact, the demands are so great that, if they were acceded to, the possibility of (it is declared) making any profit whatever would altogether vanish. That is as we understand the position from the available information. Out of friendly conference between the Committees of the National Gas Council and the Society of British Gas Industries we hope that good will come.

The Miners' Effort.

The miners are continuing to put their backs into the work of realizing larger productions of coal—not larger than their old normal; but larger than they managed to bring to the surface for some weeks succeeding the advent of the six-hour day. Following the production of 4,354,983 tons in the week ending Aug. 30, they accounted for 4,500,863 tons in the week ending Sept. 6, which means an addition of 145,880 tons. Every little helps; and the miners have to get the coal for sale, or they will themselves be the losers.

PERSONAL.

Councillor THOMAS DUXBURY, of Darwen, has, owing to ill-health, declined the invitation to be Mayor of the borough, in succession to Alderman W. Worth, J.P.

Mr. J. A. ARCHDALE, who has been Chief Draughtsman with the firm of Messrs. Goodall, Clayton, & Co., Ltd., of Leeds, and their predecessors for a considerable number of years, has lately been appointed to the position of General Manager with them. He has had the designing and carrying out of the whole of the many contracts undertaken by the firm for intermittent vertical retort installations, and has also been associated with Mr. Thomas Settle in the development of his patent steaming downward process, which is exclusively installed by them.

OBITUARY.

Herr RICHARD PINTSCH, of Berlin, died there on the 7th inst., at the age of eighty. The firm of Julius Pintsch was, the "Ironmonger" reports, founded in 1843 by the father of the deceased; and after his death Richard Pintsch became head of the business. He started his career at the age of fourteen as a tinman's apprentice; and at the end of his four years' apprenticeship (in 1855) he entered his father's business, which was quite small at that time, but was converted into a limited company in 1907. Herr Pintsch was also one of the founders of the German Incandescent Light (Auer) Company; and his firm supplied the gas illumination for almost all the railways on the Continent.

Removing Clinkers from Generators.

In the course of the recent hearing by the Commission of the request of the People's Gas Light Company of Chicago to be permitted to charge a higher price for gas, some criticisms were made by the Commission's engineers of methods of procedure adopted at the works, which the Company called in a number of outside engineers to deal with. To take one instance, it has for many years been the practice of the Company to spray with cold water the clinkers on the inner walls of the gas-generators before attempting to remove them. This, it is said, has the effect of "rotting" them so that they break easily, and at the same time makes working conditions better for the stokers. This had been pointed to on behalf of the Commission as inefficient practice, on the ground that the water is apt to crack the generator lining. It was suggested that the clinker ought to be knocked-out, while still hot, with iron bars, or cooled with steam. Mr. Klumpp, however, testified that the use of water is the regular practice in the plants of the United Gas Improvement Company, and that it does not affect the brickwork; while Mr. Evans declared that this is also the experience in St. Louis. Another witness said it would be practically impossible in some places to get clinkers out without the use of water. Three superintendents of the Company also denied that the practice has any injurious effect whatever upon the lining of the machines. Their evidence was to the effect that the Company have experimented with various methods of removing clinkers—such as pneumatic hammers—with quite unsatisfactory results. They have used steam, too, at times. But this is very slow, and necessitates letting-down the machine, with the loss of several hours' time; whereas the severest clinker can be removed by water within an hour. It would be a physical impossibility for the men to stand the heat without the use of water.

A RECORD VERTICAL-RETORT CONTRACT.

Over Half-a-Million Sterling to be Spent at the Provan Works of the Glasgow Corporation.

IN these times the gas industry is faced by the two facts that there is a tremendous scope for increasing the gas business, and that, in view of producing costs, it is necessary to bring to bear in the manufacturing system every possible means to economy. These are points that have been fully realized by the Glasgow Corporation Gas Committee and their technical advisers; and their confidence in both the future and the economies of modern carbonizing practice is shown by the fact that they have placed an order with the Woodall-Duckham Company, Ltd., which (so far as we are aware) is a record single contract for continuous vertical retorts in any part of the world. The plant is destined to carbonize 1350 tons of coal per day, in 192 retorts, each of an approximate capacity of 7 tons per day. The retorts will be arranged in eight benches, each being built with six producers. An interesting feature of the installation will be the equipping of the benches with boilers to utilize the waste-heat of the settings; the steam being employed for steaming the charges, and the surplus for other operations about the works. The utilization of waste heat in all works is one of the strong planks in the platform of the fuel economists; and Glasgow will prove on a large scale what can be done in this direction by utilizing the waste heat from the new carbonizing plant. The contract will include the necessary coal and coke handling plant, and the sum involved will be upwards of £500,000; but the exact amount has not yet been definitely settled, as certain details in parts of the plant have to undergo modification and adjustment so as to suit the requirements of the department. The plant is to be erected at Provan, on which site the late Mr. William Foulis carried out his last great work as a gas engineer, and the plant and operations at which have since been the pride also of his successor (Mr. Alex. Wilson), who, as formerly Mr. Foulis's chief assistant, had a good part in their origin—particularly in connection with the outside producers that were developed for the heating of the retort-settings. Economical handling of material was one of the chief points that Mr. Foulis had before him in planning the Provan works. Anyone who studies the differences in the levels of the site will see that he utilized them so as to bring in the coal at the highest level and to carry away the coke at the lowest level. The continuous vertical retort installation will advance the economy feature of the original planning by a very long stride. We congratulate the Woodall-Duckham Company upon their success in securing so imposing a contract for carbonizing plant on the vertical system, which will give Provan a new interest.

ELECTRICITY SUPPLY MEMORANDA.

THE British Commercial Gas Association, we understand from the minutes published last week of the Central Executive Board of the National Gas Council, are in communication with the Ministry of Health on the subject of the housing schemes. This action is not being taken any too soon; for if a paragraph published by the electrical papers indicates the general policy of the Ministry in the matter of gas and electricity supply, it is time that any misconceptions of the Department relating to gas should be cleared away. In connection with the housing scheme at Stockton-on-Tees, so the paragraph runs, it has been reported to the Corporation that the Ministry suggests that houses erected in the electricity supply area should be served with electric lighting, and that it would be the duty of the Corporation to extend the mains for this purpose. No part of the cost of the mains, however, may be charged against the housing scheme. This condition will not be regarded with such pleasant feelings as the first part of the intimation. But we should much like to know the grounds for this preferential pronouncement on the side of electricity for lighting purposes. A primary consideration in these housing schemes should be the tenants' pockets—in other words, the scheme should provide for the maximum service at the minimum cost. It is an accepted fact that the initial cost of providing electric lighting is greater than that of providing gas lighting—if in both cases the work is properly carried out with a view to safety and longevity. Maintenance is also greater with electricity. And light for light the cost is also more. Then why impose electric lighting upon the tenants, who will not be wealthy people? With the metallic filament lamp (having an efficiency of 1 candle per 1·25 watts), they will only be able to obtain 800 candle-hours per unit. Supposing in these days a unit costs 6d. (it is 8d., 9d. and 10d. in some places), six-pennyworth of gas at 4s. per 1000 c.ft. will amount to 125 c.ft., which, at only 20 candles per cubic foot used in an inverted incandescent burner, would give 2500 candle-hours. If the gas is of 500 B.Th.U. quality, it will give the consumer 62,500 B.Th.U.; if of 480 B.Th.U. value, it will give 59,200 B.Th.U. The unit will offer the consumer 3420 B.Th.U.! There is the question of eyesight, too. The people who will occupy these houses cannot afford prismatic glassware to prevent what all honest electrical men acknowledge—damaging effects to the eye through the high intrinsic brilliancy of metallic filament lamps. Electricity for cooking and heating is, on the score of cost, out of the question for such houses; and if a labour-saving fuel is wanted, it must be gas. Moreover, the tenants will not want an account for gas and another for electricity. There is a further point. The Ministry of Health is a Department of the Government; and the Government profess to be anxious to see coal economy brought about. The average efficiency of the electricity stations of the country is to-day only between 5 and 6 p.ct. on the basis of the thermal value of the coal consumed under the boilers; and even if the whole of the stations could be brought up to the level of the calculated super-station efficiency, it would only be about 12 p.ct. Then what is the ground for this preference on the part of the Ministry of Health? The gas industry has no objection whatever to electricity, as at Wrexham, being made "available" for the tenants, providing that gas is also made available, and the tenants have free choice. Their choice and adherence would prove much.

Ministry of Health and the Housing Schemes.

Electric Light and Eye Protection.

Mention has been made in the foregoing note of the effect upon the eyesight of unprotected electric lamps of the modern order; and in homes particularly where there are children, there should be great care to guard the eyes against damage from this cause. The "Electrician" has been staunch in its advocacy of eye protection. In a recent issue, it reviewed a paper read by Herr Reichenbach before the German Technical Illumination Society. In this it was held that the lowering of the cost of illumination by increasing lamp efficiency is not everything, but that the hygienic effects should be considered. The author holds that, having regard to the eye's mean capacity for clear vision, 25 lux should be taken as a minimum for illumination. This can be obtained by indirect illumination, which is specially good for the eyesight. White-hot bodies always emit a not inconsiderable amount of infra-red radiation, towards which the refractive media of the eye are comparatively transparent—more so than is commonly supposed to be the case with heat rays. The quantitative changes of the newer types of light depend mostly on the higher temperature of the illuminant. This increases the brightness of the surface, the colour over the visible portion of the spectrum changes, and more ultra-violet rays are emitted. It is partly of a physical and partly of a physiological nature to determine just what ill-effects are to be ascribed to an increased brightness in the surface of the illuminant—in fact, to find out what are the effects of "glare" is a somewhat complex problem. It is the business of scientific men to solve, without fear or favour, such problems. The length of time over which the eye is exposed is part of the question; obviously this must not continue till permanent injury results. Further, there is the breadth of pupil in the individual, the conditions of adaptability, irradiation (the filaments of a glow lamp always appear broader than they actually are), and the distance of the light; also the amount of the light from unit-service that actually reaches the eye, and the effect produced by this light. Of the present illuminants, none corresponds even distantly to Stockhausen's maximum of 0·75 Hefner candle per square centimetre, or even to the Hertel-Henker standard of 0·2 or 0·3. Therefore, there must be an attempt to make great surface-illumination as little harmful as possible. The author suggests that lamps should be surrounded with diffusing media; they should not be centrally before the eyes; it would even be well if the glare did not fall on the eye from the side, as this is known to be physiologically harmful. Shades covered with green, are useful. A number of small lamps on the ceiling is an advantageous system, and would be more efficient than the indirect method were it not for the fact that the small lamps in themselves are less efficient than one large illuminant. Staerkle, in 1904, found that seamstresses suffered from the newer kinds of lighting; and this was attributed to an excess of ultra-violet radiation. Schanz and Stockhausen have further investigated the effects of this kind of radiation; and they recommend the use of Euphor glass as a protection to the eyes. Many experiments were carried out by them and others on animals. They proved that injury might be done to the substance of the eye, and that inflammation of the outer surfaces might be caused by ultra-violet rays, which did not, however, pass through to the retina. They employed lights of such intensity as are never used in commercial work. Experiments on the fatigue of the eye have as yet given no very certain result; but subjectively it is known that green and blue lights provide agreeable sensations. For determining clearness of vision, reading tests are simplest and best; but differences in individuals must be taken into account.

A Hoary Joke in "Punch."

"Punch" in his issue of Sept. 3 had his joke at the expense of gas; and it did not escape the attention of Mr. H. C. Crews, of Manchester, who—though working on "specifications for the electrical equipment of a large housing scheme, and considering electric cooking decided upon by the Committee of a prominent hospital which previously used gas"—had sufficient time to waste to write to the "Electrical Review" on the subject. "Punch," remarks the gratified Mr. Crews, has a world-wide reputation for impartiality, and showing both sides of the question; and he might have added that "Punch," like many other humorists, makes extensive use of hyperbole in order to raise a laugh. What attracted Mr. Crews was that, on p. iv. of "Punch" for the date named, appeared an advertisement of the

British Commercial Gas Association regarding gas-fires; on p. 207 one of its satirical artists depicted the disadvantages of being blown out of one's house, and having it set on fire, by using a gas-stove. The age of the joke is as great as that of gas itself; and we are rather surprised at "Punch" serving-up such stale fare. Naturally, such an occurrence would be a great disadvantage. But how many have experienced it, and what is the proportion of such happenings to the number of people who employ gas-stoves? The advantages of gas-fires are too widely known for a piece of pictorial play of the kind to have any effect upon their popularity. Mr. Crews failed to point out that gas fires, cookers, and other appliances are to be counted by their millions, and even now, despite higher prices, their production and fitting are keeping large foundries and shops and thousands of men busily employed. The same record of popularity cannot be presented by electric heating and cooking. The gratified one says the "B.C.G.A." advertisement gives the information that two leading architects agree that £30 per house can be saved by building smaller flues, if gas-fires are adopted; and he asks: "What can be saved by abolishing flues altogether and using electric-fires?" Total abolition would mean very little difference, seeing that all the gas-fire wants is a channel in the body of the brickwork of a wall. If flues were totally abolished, then when rooms are in use in the winter time, and windows and doors are kept closed as much as possible, other means of ventilation must be provided, which would cost money; otherwise a stagnant and unhealthy atmosphere in the room would be the result. Besides, how many occupants of small houses could afford to use electric fires?

Electrical Misdemeanours.

If "Punch" has a copy of the "Electrical Review" in which Mr. Crew's letter appears, he will find there subject-matter for illustrating the disadvantages of electricity. We observe on one page, that a labourer at the Cerebos Salt Works, while waiting near the window of a pan-room, put his hands on the electric lighting wires running above the window, and was killed. An accompanying paragraph states that a man at a paper mill at Glasgow was killed while following his employment. The foreman also received a shock; and it was found the workshop was "alive." Last week information was given about a man who was killed by a shock while in his bath, with current at only 100 volts. Electrical fatalities are of weekly occurrence. Death, with electricity for its agent, stalks about in a ubiquitous fashion. One minute, a man is alive and enjoying good health; the next minute he has passed away—through the agency of electricity. Electricity, too, is an insidious fire-raising agent. Fires break out without any warning; and the electrical agent attempts to cover its own participation by self-extermination. If "Punch" wants to pictorially illustrate some of the "disadvantages" of electricity, we can favour him with plenty of material, including fatalities, fire-raising escapades, and failures of supply, which are productive of much inconvenience and loss.

A Beautiful Dream.

It is noted that Sir Charles Parsons, the President of the British Association, whose address was noticed in our editorial columns last week, does not see eye to eye with "Meteor" of the "Electrical Times." Sir Charles has not announced this fact; the information comes from "Meteor." Sir Charles believes in the pre-eminent virtues of the steam-turbine for power purposes, and apparently inclines to the view that the reciprocating engine is on its last legs. "Meteor" does not; and for the important reason that the turbine has a water boundary set to its application. Its efficiencies can only be realized at places where unlimited cooling water is available. This is an important consideration. Nor is he prepared to place too much reliance on the prognostication that very shortly an overall thermo-efficiency of 28 p.ct. will be reached by the turbine. This is the anticipated product of superb conditions reaching from the boiler-house to the working of a mammoth-scale turbine unit. It is a very definite, and yet so far as we can see a fairly reliable, assertion which says "there is no chance of any super-station in practical working conditions even approximating to such a beautiful dream. Something in the neighbourhood of 20 p.ct. marks the limit of the ambition [of such stations]; and this seems to us to represent a humiliating defeat." Thus it is that an electrical observer has to confess that he sees no prospect of electricity stations in the most favoured circumstances doing anything better than continue to waste 80 p.ct. of the energy of coal. So far as can be judged, we are rather inclined to think that as a prospective average the 20 p.ct. is also nothing but a beautiful dream.

Exceeding the Old Maxima.

For a long time electricity undertakings tried not to exceed the level of their statutory maximum prices, which in most instances are 8d. In the case of municipal electricity undertakings, the number making deficits has been increasing, and those that have previously been making them have enlarged them. Now we see more and more concerns are slipping over the old statutory maximum line. They cannot help it; it is imperative. In one issue of the "Electrical Times," it was announced that Camborne has increased its charge to 9d. per unit, and so has Lymington. From another source, it is seen that at Surbiton the price has likewise gone to 9d. But worse still is found at Newton Abbot and Fareham, where the charge has risen to 10d.

THE "SEAL OF HONOUR."

Aiding Disabled Men.

THE accompanying sketch illustrates the device which, printed or embossed upon the letter-paper, invoices, &c., of any business firm, intimates that the firm has adopted the Government scheme for aiding disabled men. Use of this seal, which has been christened the "Seal of Honour," indicates that the firm is employing disabled ex-Service men to the extent of 5 p.ct. of its staff, and that its name has been placed upon the National Roll. The scheme is to be administered by the Ministry of Labour, through their local Employment Committees and Exchanges; and in view of the fact that the fate of these men rests upon the national conscience, a large response is expected. The King's appeal, in the proclamation issued last week, has brought an immediate response; and it is confidently expected that the seal illustrated here will before long be in general use. Employers should note that the term "disabled" does not necessarily mean unable to work. Thousands of men "disabled" in the military sense are now doing useful and remunerative work in this country.

Costs of Industrial Gases.

Prof. Crabtree, of Pittsburgh, in a paper which he presented to the Engineers' Society of Western Pennsylvania, discussed various methods for the production of fuel gas, of particular interest to manufacturers in the Pittsburgh natural gas district, where the diminution in the supply of natural gas is periodically giving concern. He does not consider bye-product coke-oven gas to be a desirable substitute for natural gas, as only a few large companies feel inclined to make the big investment required for bye-product ovens; and these companies need all the gas they produce. It is probable, however, that in the future other gas companies may adopt the plan of the People's Gas Company of Chicago, and build bye-product ovens, distribute the gas, and use the coke for making water gas for domestic and commercial use. Ordinary coal gas is not a desirable substitute for natural gas, because its cost, unmixed with other gas, is prohibitive. The fuel required, either anthracite or coke, places some limitations upon the extended use of water gas; but one or both of these fuels can usually be obtained at a reasonable price. The cleaning of producer gas is neither difficult nor expensive; and he concludes that water gas is slightly more expensive than clean producer gas, if the costs of production only are taken into account. There are, however, other considerations which tell against producer gas. One of the speakers in the discussion—Mr. A. E. Blake, of the Surface Combustion Company, of Pittsburgh—remarked that, bearing in mind the difference in the fuels by reason of the great dilution of producer gas by nitrogen (which cannot be avoided in the gasification of coal in the formation of producer gas), it will be readily understood that the small additional cost of the blue water gas is as nothing compared with the advantages to be gained. As to the heat content per cubic foot, natural gas is 1100 B.Th.U., and blue water gas 300 B.Th.U. However, with natural gas one must use about 11 volumes of air to 1 of gas; and the heat content of this mixture will be about 96 B.Th.U. per cubic foot. Water gas of 288 B.Th.U. will need about 2·114 volumes of air to 1 of gas; and the heat content of the mixture is about 91 B.Th.U. per cubic foot. Thus the two gases are very close together in this respect. Coming to producer gas of 160 B.Th.U. per cubic foot, it takes about 1·3 c.ft. of air to burn it completely; but this mixture, owing to the nitrogen which dilutes it, has a heat content of only about 72 B.Th.U. Blast-furnace gas has about 99 B.Th.U. per cubic foot, and takes about 0·7 c.ft. of air; the resulting mixture being about 57 B.Th.U. per cubic foot.

German Synthetic Nitrate Plants.—Writing in the "Journal of Industrial and Engineering Chemistry," Mr. R. E. M'Connell says that during the year ended Nov. 1, 1918, the Oppau plant produced 90,000 long tons of fixed nitrogen by the Haber process. That is to say, the capacity of the plant is equivalent to approximately one-fifth the total of 3,000,000 tons of sodium nitrate furnished by Chile to the entire world during the same period. It is reported that a similar plant, which has a rated capacity of 125,000 tons of fixed nitrogen per year, has been constructed near Halle. If this is true, Germany's total capacity of 215,000 tons of combined nitrogen, by the Haber process, is equivalent to one-half of the total world's consumption of Chile nitrate. It had been stated that nitrogenous products manufactured in Germany in the year 1916 contained 400,000 tons of combined nitrogen, an amount equivalent to 2,500,000 tons of sodium nitrate, which is practically equal to the total tonnage annually mined in Chile for the markets of the entire world. Germany is now in a position to export nitrogenous products in amounts that approximate her normal consumption of 750,000 tons annually.

THE MEANING OF THE BEILBY REPORT.

By "ENGINEER."

THE letter of Dr. Charles Carpenter in the issue of the "JOURNAL" for the 16th inst. comes at an opportune moment. This article (with a slightly different title) was in draft form when the letter appeared; and it should here be mentioned that the writer holds no brief for the South Metropolitan Gas Company in promoting their own Bill embracing the full acceptance of the report.

From what one reads and hears it is plain that the gas industry in general has, to an extent, misinterpreted the report. Instead of regarding it as a charter of freedom with reference to quality, many have looked upon it as a licence to make and distribute low-grade gas without any financial penalty.

Dr. Carpenter does well to draw attention to the four classes of gas-consuming appliances mentioned in the report. Many responsible officials in the gas industry have interpreted these four figures as binding all undertakings to send out gas of one of these grades. But this was not the intention; and probably Sir George Beilby himself regrets that the four figures were ever inserted in the report, owing to the misunderstandings which have followed.

For example, in the "JOURNAL" of the 9th inst. "X" draws attention to what he considers will be a difficulty for the South Metropolitan Company. He asks how they propose to conform to the figure of 500 B.Th.U. (the highest "sample" grade mentioned in the report) when their average is round about 550. The answer is that they may not intend to work to less than 550 B.Th.U., and there is nothing in the report to compel them to.

THE RECOMMENDATIONS IN BRIEF.

So much have side-issues been drawn into the various discussions on the subject of the report, that one seems to be losing sight of its main provisions.

Omitting for the present the controversial subjects of pressure, purity, and inerts, the following appears to the writer to crystallize the recommendations:

(*a*) Gas is in future to be sold as a form of energy, and labelled (as it were) with a guaranteed strength.
(*b*) Gas undertakings must, day in and day out, conform to their labelled quality (within reasonable limits).
(*c*) The gas-consuming appliances are to be adjusted so that the consumer will get the best possible value from the energy supplied.

It should be clear to those responsible for the development of our industry that the recommendations in regard to the above matters will be carried into effect; and although they are for the consumers' benefit, yet coupled with them is the greatest possible freedom in manufacturing operations—a freedom that we should never have dreamed of agitating for five years ago.

With regard to (*a*), many overlook the fact that in pre-war days, we were in a sense selling gas according to quality. Many undertakings had a calorific standard as a minimum, and probably took good care that they did not exceed this minimum by any material percentage. Others had an illuminating standard which carried a corresponding calorific value—again within limits. Coupled with these minimum standards was a standard price. Therefore, in an indirect manner, our price represented a certain number of B.Th.U. for a penny; and as we sold more units for a penny, so our dividend could be raised.

It is only due to war pressure, and the willingness of the industry to produce toluol, that these restrictions have been temporarily removed; and, given the adjustment of our standard price to meet the existing conditions, we cannot logically object to the reimposition of restrictions.

In connection with (*b*), we cannot regard it as a hardship to be expected to adhere consistently to gas of uniform composition. As a business proposition, it should appeal to us; and our troubles would be greatly reduced, and money saved on the district by closer attention to this matter.

With regard to (*c*), the trouble, if any, is an initial one; and, by due attention to (*b*) it will not recur. We have not in the past given sufficient time and study to the design, purchase, and fixing of the appliances which are to burn the particular gas that is being supplied.

Considering these points, the action of the South Metropolitan Company, in accepting the report, has been regarded by some correspondents in the wrong light. The Company cannot surely be accused of voting for a high-grade gas. They are merely accepting the freedom offered them, and propose to use the freedom in sending out a richer article than their competitors. For this they will rightly get their premium when the consumers' accounts are sent in; for they have made it their business to get as near to uniformity as possible, and have given more attention than any company in the writer's experience to the appliances on their district.

Their acceptance of the recommendations regarding purity and inerts is (as Mr. H. E. Jones points out) a retrogression; for few gas undertakings have the physical means of conforming to the requirements. It may be that no harm will be done to the cause of the industry in general if the South Metropolitan Company were to make it clear to the parties concerned (local authorities and others) that, although in the happy position of being able to conform themselves, they do not wish their acquiescence to be taken as a precedent. Such a line of action would do them no harm, and would do the whole industry a lot of good; for we all realize that if any company can get a revision of the standard price, the South Metropolitan is that company.

THE BASIS OF CHARGING.

To many, the basis of charging for thermal units, and the adjustments necessary, seem to present difficulties which the writer is certain will disappear after close contact. The principles in operation to-day will apply equally to the future. In fixing the basis of charge, we have to keep many points in mind, the chief of which are as follows:

1. The standard must be one that can be understood by the consumer without undue mental effort.
2. The increment or decrement of unit-charge should be small in amount—equivalent to not more than 2d. or 3d. per 1000 c.ft. on the present basis.
3. It should not involve undue labour in the rental department.
4. It must have as its first factor the reading of the consumer's meter.
5. It must apply equally well to ordinary and slot meters.
6. It must be readily convertable to a standard to permit of straightforward calculation of permissible dividend compared with the new standard price.

All the suggestions which up to the present have been offered appear to ignore one or more of the above fundamental requirements. For instance, one correspondent has suggested the electrical unit, and has pointed out the simplicity of getting down to fractions of a penny—adding that he could give 2, 3, or 4 units for a penny, as the case may be. If we accepted this basis, and assuming 450 B.Th.U. gas, 2 units for a penny (each unit 3420 B.Th.U.) would be equivalent to 5s. 6d. per 1000 c.ft. If we reduce to 3 units a penny, this would be equivalent to 3s. 7½d. per 1000 c.ft., and a decrement of 1s. 10½d. per 1000 c.ft. At 4 units for a penny it would be equivalent to 2s. 9d. per 1000 c.ft.—this decrement amounting to only 10½d. It is quite obvious that this method would not be satisfactory, for the increments or decrements must be equal.

To the writer, it appears that the electrical unit is too small to permit of reasonable increments or decrements without avoiding decimals of a penny per unit running to a second place. Calculating on 450 B.Th.U. gas, the electrical unit is only equal to 7·6 c.ft., which at 5s. per 1000 c.ft. would cost less than a half-penny. It is not convenient to handle in the rental office, and is not a simple one for the consumer to grasp—having regard to the fact that out of the three factors only one is clear to him and capable of being checked by him—viz., the meter-reading.

Mr. John Bond, of Southport, in his letter to the "JOURNAL" dated July 15, advocated the unit equal to the electrical one; and he proceeded to show the ease with which he could move from 4 units to 3·8 units for a penny. But here again is the weakness that, in dropping from 4 to 3·8 units for a penny, he has a different increment per unit than in dropping from 3·8 to 3·6 units. And then we shall be in trouble in adjusting the price to conform to the standard and the corresponding calculation of permissible dividend. Our basis must be in pence per unit and not in units per penny.

A SUGGESTED BASIS.

The writer suggests a unit of "100,000 British Thermal Units." Looking in "Field's Analysis," a fair average consumption for a quarter would be 15,000 c.ft. Adhering to the beforementioned 450 B.Th.U. gas, the consumer's account would be:

$$15{,}000 \times 450 = 6{,}750{,}000 \text{ B.Th.U.} = 67{\cdot}5 \text{ units.}$$

Assume now a price of 14d. per unit, the account would be

$$67{\cdot}5 \text{ units at } 14\text{d.} = £3\ 18\text{s.}\ 9\text{d.}$$

On the present basis of charge, this would work out at 5s. 3d per 1000 c.ft. One penny per unit increment would be 4¾d. per 1000 c.ft. Thus in associating the new with the old, every penny per unit would represent in pence per thousand the number of hundreds in our calorific power. If gas is of 475 B.Th.U. then a penny per unit would be equivalent to 4¾d. per 1000 c.ft, on our present scale. We never need use an increment or decrement of less than ½d. per unit—what is now 2½d. to 2¼d. per 1000 c.ft.

The consumer's account would have a column for meter-reading, one for declared calorific value, and one for units. If we wished to compare our unit with the electrical one, we could print on every account, "One gas unit is equal in heating value to 30 electrical units."

With regard to slot meters, the proposed method offers no more difficulties than we are faced with under the present system. We have already to meet the objection that our number of feet per penny does not work out at any exact price per 1000 c.ft., and that the alteration of 16 to 15 c.ft. results in a less difference of price than altering from 12 to 11 c.ft. We are also familiar with the system of rebates, and are used to the anomaly of charging (say) 8d. extra for slots in one year and 10d. in another.

On the suggested basis, we could be allowed to charge 2d. per unit extra for slots, with a maximum limit of 2½d. to avoid fractional inconsistencies. Thus, taking the case already mentioned—that of 450 B.Th.U. gas at 14d. per unit—for slots we should be allowed to charge 16d. per unit or 14 c.ft. for one penny (at

present rates 5s. 11½d. per 1000 c.ft.). This is only 8½d. per 1000 c.ft. extra on the old scale; but it is for a supply of gas of only 450 B.Th.U.

THE CALCULATION OF DIVIDEND.

The necessary calculations for permissible dividend are quite simple; and for this purpose we must assume that Parliament intends to recognize our present financial condition, and give us the relief desired.

It appears to the writer essential that a standard calorific power must be adopted all over the country for the standard price basis. Whether this standard is 500 or 450 B.Th.U., or any other figure, does not affect the calculation, although for practical reasons 450 B.Th.U. may have advantages, representing as it does the average of low-grade and high-grade gases.

Assuming the undertaking had a standard price of 4s. with 10 p.ct. and 7 p.ct. dividends, and increments or decrements of 5s. and 3s. 6d. for each penny, with an obligation to supply gas at or about 500 B.Th.U. It could be argued that the burden of the war had caused an increase in the total cost of distributed gas of 2s. per 1000 c.ft., and (assuming that the case was proved) a revised standard price of 6s. would not be unreasonable. This must now be converted to the new basis; and therefore 6s. is the permissible standard charge for 450,000 B.Th.U., or 16d. per unit. Thus we arrive at the new standard price. Our old increment of 1d. per 1000 c.ft. is about ¼d. per unit on the new scale. In our typical case, we take gas sold at 14d. per unit; and, therefore, the shareholder would be entitled to eight increments of dividend of 5s. and 3s. 6d. respectively.

Going back to the old 4s. per 1000 c.ft. standard, the selling price would have been 3s. 4d. to enable the shareholder to draw eight increments; and it has been proved that the present price of 14d. per unit is equal to 5s. 3d. per 1000 c.ft. The difference (5s. 3d., less 3s. 4d.) thus represents the increase in manufacturing cost which is claimed.

Many undertakings may embrace the opportunity of righting certain dividend anomalies, and of rounding-off dividend sums when making the change.

THE HALF-WAY HOUSE.

In some quarters a wish has been expressed that we should in effect charge for thermal units by varying charges per 1000 c.ft. according to scale, and continuing our existing methods of calculating the rental as well as the dividends, after having our standard prices increased by Parliament to meet new conditions. This method has many advocates; and there is much to be said for it. But it is only the half-way house.

THE TYPICAL CASE.

Assume our typical case worked out on this basis—*i.e.*, a new standard price of 6s. with 450 B.Th.U. gas as the standard, and 450 B.Th.U. also supplied. If the charge is 5s. 3d. (or 14d. per unit on the new basis), the consumer would merely get his account for 15,000 c.ft. at 5s. 3d. = £3 18s. 9d., with a note that the gas is 450 B.Th.U. in grade. Here the consumer's interest in quality would cease; and the information would only be printed as a legal formality—indicating that the shareholder is paid on that basis. The secretary would calculate nine increments of dividend at the present rates. Now suppose the quality went up to 475 B.Th.U., and the price to 5s. 6d. The consumer would have his usual account (say) 14,200 c.ft. at 5s. 6d. = £3 18s. 1d. The note at the foot would state the quality as 475 B.Th.U.; but it would only be useful in calculating the dividend. For this purpose the price of 5s. 6d. for 475 B.Th.U. gas would be calculated back to the 450 B.Th.U. basis—equivalent in this case to 5s. 3½d. Thus the shareholder would be entitled to nine-and-a-half increments; and it is seen that by this method fractions cannot be eliminated, and would have to be provided for in any legislation. The consumer would, however, have it in the back of his mind that the 3d. increase per 1000 c.ft. was unwarranted, particularly if his consumption did not show any diminution.

This method does not appear to the writer to be in accordance with the spirit of the report; and only in an indirect manner can it be described as a method of charging for heat units. Its operation is, in fact, only directly effective in calculating dividends.

[This article deals only with problems concerned in charging for gas. The problems associated with manufacture are of greater magnitude, and will be treated of in a further contribution.]

Temporary Increase of Charges Act.—Orders have been made by the Ministry of Health under the Statutory Undertakings (Temporary Increase of Charges) Act authorizing the Batley Corporation and the Cowes Urban District Council to increase the charge for gas from 4s. 6d. to 6s. per 1000 c.ft.

Cast Retorts.—Those members of the Institution of Gas Engineers who inspected the sample retort exhibited at this year's meeting, will be interested to read the following extract from the recently issued report of the Committee for Scientific and Industrial Research: "Demonstrations of a new method of casting 5 ft. gas-retorts have been given before the Institution of Gas Engineers; and a careful examination by the Research Committee of the Institution of the retort produced proved satisfactorily that the process used for its manufacture was thoroughly practicable. This important industrial result has been produced at the cost of a few hundred pounds."

THE DELLWIK-FLEISCHER "TRI-GAS" PROCESS.

In the "Journal für Gasbeleuchtung" recently [Vol. LXII., pp. 261-3] there appeared an article by Herrn. A. Pott and E. Dolenski, giving particulars of the results obtained in a long-period working of the "Tri-Gas" process, with recovery of low-temperature tar and ammonia. For the following abstract of the article we are indebted to the "Journal of the Society of Chemical Industry."

The direct conversion of bituminous coal into water gas, or a gas resembling water gas, is successfully achieved in the Dellwik-Fleischer "Tri-Gas" process. In this process it is essential that the appropriate temperatures be maintained at specific parts of the producer. Subsequent to the erection of a "Tri-Gas" producer in Vienna, the gas production of which was from 80 to 150 cb.m. per hour, a plant comprising three producers, each of ten times this capacity, and provided with revolving grates, was erected; and it was in practically continuous operation for five months (from April 6, 1918), during which period the working of the plant was eminently satisfactory. The plant was operated during this period with a strongly caking gas coal, employed either alone or in conjunction with lignite, briquettes, coke, or with the addition of 25 p.ct. of raw lignite. The coal employed yielded 11 p.ct. of ash, 5·5 p.ct. of water, and its calorific value was rated at 6850 calories. The raw lignite contained 55 p.ct. of water; its ash content was 3·15 p.ct.; and its calorific value was about 2300 calories. The producers were worked at a medium temperature—gas of a calorific value between 2800 and 3000 calories being produced, together with a good quality low-temperature tar. The yield of gas was about 1·8 cb.m. per kilo. of fuel. The average composition of the gas was: Carbon dioxide, 13·3 p.ct.; sulphur compounds, 0·3 p.ct.; oxygen, 0·4 p.ct.; carbon monoxide, 23·9 p.ct.; methane, 5·5 p.ct.; hydrogen, 51·5 p.ct.; nitrogen, 5·1 p.ct. The calculated calorific value was 2883 calories. When coal alone was employed, gas of a calorific value of 3875 calories was made; the producers being operated at a higher temperature. An increase in the calorific value of the gas is accompanied by some depreciation in the value of the low-temperature tar obtained. The throughput of each producer varied between 12 and 15 tons per twenty-four hours; hand stoking being employed throughout the period. Employing mechanical stokers, a throughput of from 15 to 20 tons could be realized. The tar obtained contains no naphthalene. It is port-wine red in colour by transmitted light. Its specific gravity is 1·04 at 15°. It is completely soluble in benzene, and to the extent of about 62 p.ct. in benzine. It contains from 35 to 40 p.ct. of phenols and resin acids. By vacuum distillation, it yields 26·7 p.ct. of fuel-oil and lubricating (spindle) oil; 32·5 p.ct. of a very viscous lubricating oil; 3·3 p.ct. of solid paraffins; 11·5 p.ct. of resin; and 26 p.ct. of pitch. The yield of water-free tar from the mixture of coal and 25 p.ct. of raw lignite was between 5 and 6 p.ct.

RUNNING OF COLLIERY STEAM-BOILER PLANTS.

There has been reprinted from "Engineering" an article by Mr. D. Brownlie, B.Sc. Hons. (Lond.), dealing with the performance of colliery steam-boiler plants, and the saving to be obtained by their re-organization. Complete working details are given in connection with no less than a hundred typical colliery steam-boiler plants—data obtained in the past ten years' continuous experience of Messrs. Brownlie and Green, Ltd., as specialists in coal economy, by scientific methods of steam generation. The author shows by these figures that the average net working efficiency of colliery steam-boiler plants is only about 55·5 p.ct., and that by carrying out a reorganization of these plants on modern scientific lines, it is easily possible to get up to 70 p.ct. A steam-boiler plant, run on modern scientific lines, will give from 75 to 82 p.ct. efficiency with ordinary quality fuel and normal conditions of working; but for collieries he only thought the lower figure of 70 p.ct. would allow for the considerable fluctuation in the quality of the coal burnt. This would represent a saving, by burning the same coal more efficiently, of about 21 p.ct., or nearly 4 million tons a year, of the coal consumption of (say) 18¾ million tons per annum in colliery plants. In addition to this, at least another 15 p.ct., equal to some 2¾ million tons a year, can be saved by burning refuse coal. In this way the total saving would be 36 p.ct. —equal to (say) 6,600,000 tons per annum. Beyond this saving on the generation of the steam alone, there is much economy to be secured in the utilization of the steam plant; and taking all the facts into consideration, Mr. Brownlie does not think it an exaggeration to say that 50 p.ct. of the colliery coal requirements of the country—or 9¼ million tons a year—could be saved. With the present position of the coal supply of the country, such huge figures as these possess an even greater importance than they would do under other circumstances.

We learn that Mr. S. E. Whitehead has given up abstracting work for the "Transactions" of the Institution of Gas Engineers, and Mr. A. V. Hendrickson has been asked, and has decided, to take them on again.

COMPARATIVE TESTS OF GLOVER-WEST AND DESSAU VERTICAL RETORTS.

The "Journal für Gasbeleuchtung," Vol. LXII., pp. 349-55 and 365-69 contained an article on this subject, which [with the accompanying table of results] has been abstracted by the "Journal of the Society of Chemical Industry."

The tests referred to were made on settings newly-erected in the Mariendorf Gas-Works, Berlin, and each test extended over four to six days. A South Yorkshire (Denaby Nuts) and a Durham (Lambton) coal were carbonized in each setting.

The coke from the Dessau retorts was dense, hard, fissured lumps; while that from the Glover-West retorts was lumpy, but porous, spongy, and fissureless. When forked, the latter left the larger proportion of breeze, but better withstood dropping from a height of 4·2 m. It also disintegrated more than the other after three hours in a revolving drum. All samples ultimately took up 23·5 p.c. by weight of water, although at varying rates. The yields of tar and ammonia were substantially the same for both systems. The quantity and quality of gas produced was practically identical in each case. The Glover-West system shows superior fuel economy in use; but the Dessau has the higher rate of carbonization. The construction and control of the Glover-West setting receive detailed discussion, and in particular the utilization of the heat abstracted from the coke by the secondary air. This air is not preheated by the waste gases, to which the heat of the coke is ultimately transferred, thereby raising their temperature to about 850° on leaving the setting, as against 400° in other systems. In the ordinary systems, this heat is lost in quenching the coke; but when carried in flue gases at so high a temperature, it becomes available for heating boilers, &c. The better fuel economy in the Glover-West system, in spite of the hotter waste gases, is accounted for by the more efficient transmission of heat across the retort-wall, due to the greater average difference of temperature of the flue and the charge.

	Denaby Nuts.		Lambton Coal.	
	Glover-West.	Dessau.	Glover-West.	Dessau.
Loss on air drying	4·36 p.ct.	3·45 p.ct.	2·94 p.ct	2·36 p.ct.
,, at 110° C.	2·92	3·41	1·65	1·57
Ash	2·95	3 05	8·64	8 19
Fixed carbon	60·53	60·78	60·04	60·69
Volatile matter	29·24	29·31	26·73	27 19
Coal carbonized in 24 hours, kilos.	17,070	18,290	15,550	20,100
Gas made in 24 hours, cb.m.	6,650	7,290	5,460	7,280
Fuel used in 24 hours, kilos.	1,910	2,640	2,125	2,945
Gas made per 100 kilos. of coal at 0° C., cb.m.	38·95	39·8	35 1	36·2
,, ,, ,, ,, 15° C., cb.m.	41·8	42·75	37 7	38·85
,, ,, ton of coal at 15° C., c.ft.	15,000	15,330	13,520	13,930
Fuel per 100 kilos. of coal, kilos.	11·2	14·4	13 65	14 65
,, 100 cb.m. of gas at 0° C., kilos.	28·8	36·2	38·95	40·4
Yield of coke per 100 kilos. of coal, kilos.	66·3	68·0	..	..
Calorific value (gross) 0° C., 760 m.m., $\frac{\text{cals.}}{\text{cb.m.}}$	5245	5185	5280	5280
,, ,, ,, 15° C., 760 m.m., $\frac{\text{cals.}}{\text{cb.m.}}$	4890	4830	4920	4920
,, ,, ,, ,, ,, $\frac{\text{B.Th.U.}}{\text{c.ft.}}$	550	543	553	553
,, multiple $\frac{\text{cb.m.}}{\text{100 kilos.}} \times \frac{\text{cals.}}{\text{cb.m.}}$	2045	2065	1853	1913
,, ,, $\frac{\text{c.ft.}}{\text{ton.}} \times \frac{\text{B.Th.U.}}{\text{c.ft.}}$	8,250,000	8,320,000	7,480,000	7,720,000
Specific gravity	0·433	0·423	0·415	0 393
Illuminating power (Hefner candles)	13·2	13·2	12·5	13·6
Sulphur in 100 cb.m. purified gas, grams	35·6	30·3	48·3	37·2
CO_2 in gas, p.ct.	2·4	2·6	2·2	2 2
N_2 in gas, p.ct.	2·9	2·2	3·4	1·6
Gas yield per 100 kilos. ash and moisture free coal, cb.m.	41·1	42·65	39·5	40·25
Calorific mutiple in ash and moisture free coal	2155	2210	2085	2125
Heat recovered in gas per 100 heat units in coal	27 5	27·65	25·3	26·1
Ash and moisture free coke used per 100 kilos. of ash and moisture free coal, kilos.	10·75	14·1	12·95	13·85
Heat units used in coke per 100 heat units in gas	39 6	48·1	52·1	53·1
,, ,, ,, ,, coal	10·7	13·4	12·9	13 85
Gas analyses:				
Carbon dioxide	2·10	2·75	2·00	2·8
Heavy hydrocarbons	2·00	2·55	2 05	2·2
Oxygen	trace	trace	trace	trace
Carbon monoxide	12·35	13·80	10·00	11·1
Hydrogen	54·65	56·55	55 65	55·6
Methane	24·10	21·35	26·00	25·0
Nitrogen (by difference)	4·80	3 00	4·30	3·3

Globe Suspension.

Screws and gas-globes have a mutual antipathy; and in the hands of careless persons the undue tightening of screws means certain destruction to globes. To say the least, the screw is a crude means of suspension for the globes of inverted incandescent lamps; and various devices have been designed with the object of providing a means of suspension which would be protective of glassware, and at the same time permit of easy removal and replacing of the globe. A few days ago, Mr. Lindsay Boyd, of the Second Pioneer Battalion of the Australian Expeditionary Force, and connected with the Works Department of the Metropolitan Gas Company of Melbourne, brought in for our inspection a model of an arrangement he has devised for globe suspension for inverted burners, and for quickly and securely placing them in position. The globe is slipped into the band which supports it; and in this there are slots cut. On the frame of the body of the burner, there are small lugs; and when the globe suspender is pushed up in the grooves provided, and a twist given to it, the lugs of the upper part slip into the slots of the lower ring, and so the globe is held securely, though with plenty of play. Lugs are also provided on the band for supporting shades. The arrangement (which has been protected) is very simple; and it can be applied to inverted lamps of any size. It should be exceedingly useful in connection with the maintenance system. Mr. Boyd will be returning to Australia shortly; but any burner maker who is interested can communicate with him during the next few days at No. 77, Glencoe Avenue, Ilford.

North of England Gas Managers' Association.—The autumn meeting of the Association will be held in the Station Hotel, York, on Saturday, October 11, under the presidency of Mr. Harold E. Bloor, who will deliver his address. There will be a visit to the works of the York Gas Company, where tea will be provided on the invitation of the Directors. The show-rooms of the Company will also be open for inspection during the afternoon.

United States Kelp-Potash Plant.—There is described, by Mr. J. W. Turrentine and Mr. Paul S. Shoaff, in the September issue of the "Journal of Industrial and Engineering Chemistry," the experimental Kelp-Potash plant of the United States Department of Agriculture, designed for the determination of the best methods of dealing with kelp for the extraction of potash salts and the simultaneous recovery of other valuable products. The plant was erected during the summer of 1917, and put into operation in the early fall of that year. A hundred tons of raw kelp per day are subjected to a process involving drying, destructive distillation, lixiviation, evaporation, and fractional crystallization, for the preparation of high-grade potassium chloride. The bye-products—kelp oils, creosote, pitch, ammonia, bleaching carbons, salt, and iodine—are yielded in commercial quantities by this process. The main problem now in hand is their commercialization. It is confidently believed that they will be made to yield sufficient revenue to enable the main product—potash salts—to be marketed successfully in competition with potash from foreign sources. Complete operating costs data are being tabulated covering the various details of manufacture.

CONFERENCE ON FUEL ECONOMY

AT THE AUTUMN MEETING OF THE IRON AND STEEL INSTITUTE.

A feature of the Autumn Meeting of the Iron and Steel Institute, which was held last Thursday and Friday at the Institution of Civil Engineers, Great George Street, S.W., was a general conference on Fuel Economy, which took place on the first-named day—under the chairmanship of Sir Robert Hadfield, Bart.

Sir ROBERT HADFIELD, who presided, said that in the recent almost tropical weather we were rather apt to forget that winter time would soon be upon us, and with it the need for every possible economy in the use of fuel. The stoppage of the supplies of coal, not only for manufacturing but also for domestic purposes, would be of the most serious moment to Great Britain. It was impossible to think that the miners would take the foolish attitude of bringing the trade and commerce of the country to a standstill; for among the sufferers would be millions of the workers themselves throughout the country. It was hoped, therefore, that the papers which were to be presented to the Institute would direct attention to this very important question. Some time ago, when President of the Society of British Gas Industries, he offered a prize of £100 for the best essay on "Fuel Economy, whether as regards Lighting, Heating, or Melting." There was quite a keen competition for the prize, which was eventually awarded by the Council of the Society to Mr. F. W. Epworth, of the Richmond Gas Stove and Meter Company, of Warrington. From the data in Mr. Epworth's essay, the graphs given in the joint paper by himself and Mr. Sarjant (of the Hadfield Research Laboratory) had been prepared. It was because he was so pleased with the results of the competition that he had brought the subject before the Council of the Iron and Steel Institute; and this meeting was the result. He dealt exhaustively with the question of fuel economy in his Presidential Address to the Society of British Gas Industries in April, 1918, and was glad to find that the data and information there given had been much appreciated—in fact, about 1500 copies of the address had been circulated far and wide. He had also taken the opportunity of bringing the subject before the Federation of British Industries, as it seemed to him, quite apart from the technical side, that it was most important that, by means of their widespread organization, special emphasis should be laid not only on the scientific, but upon the commercial side of fuel efficiency. The Fuel Efficiency Committee of the Federation of British Industries, consisting of twelve members, had drawn up a scheme of organization, including a study of the conservation of fuel and developing and maintaining efficiency in fuel practice. The functions of the organization were to cover: (1) Periodical inspection of sources of fuel; (2) investigations of practice by means of schedules and personal investigation; (3) control and use of fuels, including grading, classification, and allocation (the introduction of index figures as to consumption per furnace-hour, &c., would be desirable); (4) the training of pupils; (5) the training of workmen, including (*a*) books of instruction, (*b*) granting of certificates, &c.; (6) encouragement of mutual interchange between firms and industries of statistics, &c. It was proposed to appoint a Committee of all the trades wishing to co-operate in the scheme, and this would act as an executive body. He would not go into further detail as to the scheme, full particulars of which could be obtained from the Secretary of the Federation. It should be noted, however, that all information obtained from those in the organization would be treated as confidential, unless the firms authorized publication. He himself thought that in fuel economy matters there was no need for secrecy. With regard to the training of workmen, experience in his own works had been very gratifying. In other words, if the question of fuel economy was placed properly before the worker, he quickly responded and endeavoured to assist his employer. In this connection, the Committee of the Federation of British Industries would be glad to assist by lectures, distribution of pamphlets, and others means which could be used as educational propaganda in the various industries. It should not be forgotten that America and Germany had established important fuel-research institutes and bureaux. During the discussion upon the report of the Fuel Economy Committee of the British Association at Bournemouth the previous week, Sir Charles Parsons, the President of the Association, attended and gave a very strong assurance that our own Fuel Research Board, over which Sir George Beilby presided, was hard at work, and would soon be in a position to give a helping hand. As the Fuel Research Board would soon have spent £100,000, there was no doubt that it would be largely instrumental in assisting to solve the many problems presented to us. He would like to refer to a report on "The Energy Resources of the United States; a Field for Reconstruction," by Messrs. C. G. Gilbert and J. E. Pogue, of the Division of Mineral Technology, United States National Museum. To those who had not seen the report, he strongly suggested that they should obtain a copy. This bulletin was a specimen of the excellent work done under the direction of the Smithsonion Institution; and it seemed a pity that we in this country had not something of the same kind. While speaking of America, he might say that several people asked, in the discussion at Bournemouth, how it was that the coal output per man in America was so much more than in this country. It must not be forgotten that many American collieries were not hundreds of yards, but only some hundreds of feet in depth. Many of them, also, were open workings; it being only necessary, so to speak, to scratch the ground and there was the coal. He called upon Prof. Bone to read his paper.

FUEL ECONOMY AND CONSUMPTIONS IN THE MANUFACTURE OF IRON AND STEEL.

A report on "Fuel Economy and Consumptions in the Manufacture of Iron and Steel" was presented on behalf of the British Association Fuel Economy Committee by Prof. WILLIAM A. BONE, D.Sc., F.R.S. (Chairman), Sir ROBERT HADFIELD, Bart., F.R.S., and Mr. ALFRED HUTCHINSON, M.A. The extent of the report renders it impossible to do more here than notice some of the points that are discussed in it.

The introduction and the historical section must be passed over entirely—devoting attention to the main thesis of the report, "that the achievement of the utmost fuel economy in a modern iron and steel works is essentially a matter of the scientific organization and position of the plant as a whole, with a view to utilizing to the best advantage, in the steel works and rolling mills, the energy in the surplus blast-furnace and coke-oven gases." This, the report says, has been shown to be sufficient, not only for converting molten iron from the blast-furnace into steel, but also for rolling the resulting ingots into finished steel sections. The possibility of attaining such an ideal is primarily due to three great technical developments which have been made since 1880—namely:

(1) In the manufacture of metallurgical coke in chamber ovens with heat recuperation and bye-product recovery, which have mainly been due to the efforts of Continental (Belgian and German) chemists and engineers.

(2) In the generation of power in internal combustion engines from cleaned blast-furnace gas, the practical possibility of which was first demonstrated by the late Mr. B. H. Thwaite in 1894-5, and was afterwards realized on a large scale by Messrs. Bailly and Krafft, under the leadership of the late M. Adolph Greiner, at the Seraing works of the Société Cockerill in Belgium.

(3) In methods of cleaning blast-furnace gas (*a*) by water washing, as in the Thiessen apparatus; or, preferably, (*b*) by electrostatic methods, which have recently been developed in this country.

The economy in fuel which would result from the concentration of bye-product coke-ovens, blast-furnaces, rolling-mills, and steelworks on one site, coupled with the utilization of the combined surpluses of coke-oven and cleaned blast-furnace gases, partly in large internal combustion engines driving dynamos generating electricity for operating the rolling-mills and all other machinery on the plant, and partly also to displace producer gas in the steel furnaces and soaking-pits, had become manifest during the early years of the present century, largely as the result of Continental experience.

Already in 1910, the late Mr. T. C. Hutchinson had satisfied himself, as the result of his experience and investigations at the Skinningrove works, that, with a proper concentration and arrangement of the various parts of the producing units, "the time would shortly come when ironstone would be brought in at one end of the works and finished steel would be turned out at the other; only such coal being used as was required for the coke-ovens to make sufficient coke to smelt the ironstone."

As the result of his association with Mr. Hutchinson's enterprise at Skinningrove, Prof. Bone was enabled to publish, in 1916, a diagram relative to the concentration and disposition of plant requisite for the production of a ton of finished steel sections from Cleveland ironstone and Durham coke, with the expenditure of no more than 1·6 tons of coal charged into the coke-ovens.

The subject was also dealt with in two reports prepared for the Coal Conservation Committee (1) by Prof. Bone on the "Manufacture of Metallurgical Coke," and (2) by Mr. Benjamin Talbot upon "Fuel Economy in a Modern Steel Works Unit, designed for the Heavy Steel Trades." Mr. Talbot was somewhat more conservative in his estimate of the fuel requirements than Prof. Bone, saying (in regard to the production of finished steel sections from British ores) that, "though the calculations show that the coal carbonized at the ovens can yield sufficient power for the operation of the works, yet for the sake of safety it is assumed that an extra 2 cwt. of fuel per ton of finished material is required. This, added to the 33 cwt. of coal used in the coke-ovens, gives a total of 35 cwt. as being the total fuel required per ton of finished material." Prof. Bone, on the other hand, is convinced that it will ultimately be found that the extra 2 cwt. referred to will not be needed. It is, however, satisfactory to note the close agreement shown by these two reports, between the conclusions arrived at by two entirely independent investigators viewing the problem from somewhat different standpoints.

We may therefore feel warranted in regarding the consumption of no more than 1·75 tons of good coking coal per ton of finished steel sections produced as a "practical ideal" for a modern British plant comprising coke-ovens, blast-furnaces, steelworks, and rolling-mills, properly disposed on one site, and under one control and management. Certain conditions are, however, either essential or desirable for the achievement of such an ideal. Some of the more important of these may be indicated as follows:

(1) Bye-product coke-ovens, blast-furnaces, steelworks, and rolling-mills must all be concentrated on one site, and suitably laid out in relation to each other,

(2) The bye-product coke-ovens must be of the regenerative type, so as to yield the largest possible amount of surplus gas. [The question of whether or not the ovens should be heated by "dry-cleaned" blast-furnace gas, in order to increase the surplus of the richer coke-oven gas, is an important subsidiary one which is worthy of attention.]
(3) The blast-furnaces should be fitted with double bells, in order to minimize loss of gas. The blast should be generated by means of a gas-driven blowing engine. There should also be a proper distribution of the materials in the furnace by means of a suitably dimensioned bell.
(4) The gases leaving the furnace should be dry-cleaned, preferably by some electrostatic method, so as to reduce their dust content to about 0·1 gramme per cubic metre. The hot-blast stoves should be heated by this dry-cleaned gas. The gas intended for generating power in gas-engines must be further cleaned until its dust content does not exceed 0·015 gramme per cubic metre.
(5) There should be separate supplies of surplus coke-oven and blast-furnace gases throughout the plant. The mixing of the two should be carried out at the various points of consumption as required.
(6) The gas-engines in the power-house should preferably be run on cleaned blast-furnace gas only. For steel furnaces and soaking-pits a mixture of blast-furnace and coke-oven gases, in such proportion as to yield heating gas of between 160 and 180 B.Th.U. per cubic foot, should be used.
(7) The rolling-mills should preferably be electrically (not steam) driven.
(8) There must be sceintific management and control throughout the whole heating system by properly trained fuel technologists, for it is essential that every available heat unit in the plant shall be tracked-down and effectively utilized to the best advantage.

Taking a typical modern Cleveland plant, using 22·5 cwt. of coke per ton of pig iron produced, Prof. Bone has calculated that the heating value of the combined blast-furnace and surplus coke-oven gases per ton of iron is equivalent to 15 cwt. of the same coke, and that (assuming a hot-blast stove efficiency of 75 p.ct.) no more than 45 p.ct. of the blast-furnace gas need be used for generating and heating the blast. The amount of heat in the surplus gases per ton of iron available for the steel-works power-house and rolling-mills would then be equivalent to that in about 8·5 cwt. of a good bituminous coal. And inasmuch as the average efficiencies of gas-producers and boilers in steelworks is certainly not higher than 75 p.ct., the effective coal equivalent of the surplus gases would be at least 11·3 cwt. per ton of iron produced at the blast-furnace; and, if properly utilized, this should be sufficient to meet all heat and power requirements in the steel-works and rolling mills.

Up to this point, there have not been mentioned certain further possible economies which scientific investigation and organization ought in the near future to effect: (*a*) The utilization of the heat in the molten slag from the blast-furnace; and (*b*) the recovery of the heat now lost in gas-engine exhausts and steel-works chimney gases.

Recoverable Heat in the Slag.

The proportional amount of heat carried off in the molten slag from a blast-furnace obviously varies according to the character of the ore smelted and the amount and composition of the slag made per ton of iron produced.

The latent heats of fusion of blast-furnace slags vary between 90 and 120; and their specific heats lie between 0·29 and 0·33. Prof. Bone has calculated, in regard to a Cleveland furnace producing 1·75 units of slag per unit of pig iron, that the heat at present carried off in the molten slag is equivalent to that in about 2·62 cwt. of coke per ton of iron produced, or to about 11·65 p.ct. of the heat of combustion of the carbon charged (as coke) into the furnace. In Mr. W. L. Johnson's experiments at the Clarence Works of Messrs. Bell Bros., Ltd., of Middlesbrough, the heat actually recovered, in the form of low-pressure clean steam by a "quenching" method, would appear to be equal to·5 p.ct. of the total heat of combustion of the coke charged into the furnace.

Heat Lost in Gas-Engine Exhausts and Chimney Gases.

The sensible heat in the exhaust of a gas-engine is probably not less than one-third of that developed in the cylinder; and two-thirds of the energy so lost might be recovered by means of a good waste-heat boiler. Mr. Knight's experiments at Skinningrove showed that nearly 30 p.ct. of the heat supplied to the hot-blast stove is carried away from it by the waste gases. Such a loss would be, at a very moderate estimate, equivalent to the heat developed by the combustion of 1 cwt. of coke per ton of iron produced, of which at least half should be recoverable, provided that the stoves were worked with dry-cleaned gas.

Another large avoidable loss of heat occurs in the waste gases from open-hearth furnaces and soaking pits. The recovery of these lost heat units is a problem which will undoubtedly, in the near future, demand the attention it deserves; and its solution will accelerate the disappearance of the gas-producer from the "self-contained" iron and steel plants to which this part of the report refers.

Week-End Gas Losses.

One further matter calls for remark in regard to what may be termed the "ideal" plant—namely, the important question of how to utilize the surplus blast-furnace and coke-oven gases during the week-end intervals when the steel plant and rolling-mills are all idle. To provide storage capacity for all the millions of cubic feet of such gases as would be generated in (say) twenty-four hours in the coke-ovens and blast-furnaces would probably involve prohibitive capital outlay. It might, however, be possible to erect gasholders of sufficient capacity to store the surplus coke-oven gas as a reserve against emergencies during the remainder of the week. [In Mr. Houbaer's valuable paper on the "Utilization of Blast-Furnace and Coke-Oven Gases in Metallurgy" at the Brussels meeting of this Institute in 1913, it was reported that the Cockerill Company were then erecting at their Seraing works a 50,000 cubic metre (1,650,000 c.ft.) holder to store their "week-end" make of coke-oven gas.] The problem is, however, one for which no general solution can at present be suggested, though local solutions of it may in some cases be found.

Linking-up of Plants.

In districts such as Cleveland, where the smelting plants and the steel-works are concentrated in a comparatively small area, the conditions are favourable to the success of "linking-up" schemes, as a means of realizing more fully the benefits of the policy outlined in this report, by equalizing the loads on the power-houses of the various plants during the working week. In this connection, the main transmission system of a public electric power company might be effectively utilized.

Problem of the Isolated Blast-Furnace Plants.

The problem of fuel economy in regard to a blast-furnace plant which is not connected with steel-works largely resolves itself into a question of finding profitable extraneous use, or uses, for the surplus gases and recoverable waste heat which cannot be employed on the plant itself. It is, indeed, depressing to have to record the confession of one firm that they have 40 p.ct. of gas above their requirements which is "allowed to go to waste." But we fear that a similar admission would have to be made by many other undertakings, if a strict inquiry were instituted into their fuel consumptions.

It will, as a rule, undoubtedly pay any firm to make coke in their own regenerative bye-product ovens on a site adjacent to the blast-furnaces. In the case of a Cleveland furnace making 1000 tons of pig iron per week, and using no more than 22·5 cwt. of coke per ton (which means working under the best possible conditions), it can be shown that the total gas made per hour at the furnaces will be about 1,115,000 c.ft. at 60° Fahr. and 30 in. barometer. If this were electrostatically cleaned, and used to the best advantage on the plant, half of it should suffice to generate and heat the blast. The potential energy of the other half, if converted into electric power with an overall efficiency of 20 p.ct., would be capable of developing 3350 KW. continuously at the switchboard. The available surplus coke-oven gas would amount to a further 48,000 c.ft. per hour, or sufficient to generate about 1150 KW. continuously. Hence the total available power from the combined gases would be about 5000 KW. continuously. This does not take any account of the power derivable either from the stove waste heat or gas-engine exhausts, or of the heat carried away in the molten slag and iron, all of which might be turned to profitable use.

No doubt the best way of disposing of such surplus gas and waste heat would be to sell them to an electric power company for converson into electricity. But if there is no power company near at hand to buy the energy, then it might be used to generate electricity for some electro-chemical process, such, for instance, as (i.) the manufacture of nitric acid from the air, or (ii.) some electro-metallurgical or electrolytic operation. What ought to be realized is that the combined bye-product coke-oven and blast-furnace plant is not only an efficient producer of iron, but that it simultaneously, and of necessity, generates a most valuable power gas, of which the utmost use must be made in the interests of national economy.

Analysis of Present-Day Fuel Consumptions.

An invitation by the Committee to make detailed returns of their fuel consumptions was responded to by 25 firms selected as being representative of their class. These returns are analyzed in the report, the idea of which was to obtain a fair idea of fuel consumptions throughout the country as a whole.

Coke Consumptions in Crucible Steel Smelting.

Though the prime object of the Committee's inquiry was to obtain data concerning the consumption of fuel in the manufacture of structural steel, two Sheffield firms kindly supplied certain information respecting the coke used in melting steel in their crucible furnaces. One of them reported a coke consumption of 2 tons 15 cwt., the other 3 tons 7½ cwt. for the melting operation only—*i.e.*, not including annealing of the pots. Both firms reported adversely regarding the substitution of bye-product for beehive coke in their crucible furnaces. Whether or not (and if so, to what extent) allegations about the inferiority of bye-product coke for crucible steel melting are well founded, ought, the report says, to be made the subject of thorough and independent scientific inquiry in the interests of national economy. It can, however, be definitely said there is no ground for assuming that bye-product coke has not sufficient heating power owing to so much having been taken out of it in obtaining the bye-products. Such differences as there may possibly be between the suitability of beehive and bye-product cokes for the purpose in question must (if they exist at all) be due to quite other causes,

which should be capable of easy discovery and precise definition. Moreover, if a real comparison is to be made between the suitabilities of the two kinds of coke in question, it ought to be in respect of consignments made from the same coal, and not (as is often the case) between cokes produced from different coals. There seems no real ground for supposing that, were the same coal carbonized (*a*) in beehive and (*b*) in modern bye-product ovens respectively, the coke from the former would be either harder or cleaner than the other. The matter is one demanding much further investigation before any final conclusion can be reached.

In reply to the questions whether there is any practical objection to the use of gas instead of coke for melting purposes in the manufacture of crucible steel, one of the firms stated that they were able to control the heat more and get a better product with coke than with gas. The other firm said they had no experience of gas-melting, and therefore could not answer the question—adding, however, that exhaustive experiments made in Sheffield some years ago had resulted "in a draw" between gas and coke. The subject is one of considerable importance, and ought to be thoroughly explored.

CONCLUDING REMARKS.

The results, as a whole, prove beyond all question that much yet remains to be done before British iron and steel works will have attained to anything like the practical ideal of fuel economy which at least three leading iron and steel makers have declared to be even now attainable. None of the returns shows that, even where coke-ovens, blast-furnaces, steel-works, and rolling-mills are concentrated on one site and under one management, the manufacture of the steel and its subsequent rolling into finished sections have as yet been accomplished with no other expenditure of coal than that which must be charged into the coke-ovens to make the coke required for the blast-furnace.

There are so many directions in which further large economies may be effected, even when the necessary concentration and co-ordination of plant units have been secured, that we cannot hope to do more than indicate a few of the more obvious of them. The surplus blast-furnace and coke-oven gases can undoubtedly be much better and more fully ntilized than they are to-day on most plants. The data published in the report concerning the temperatures and compositions of waste gases from boilers, stoves, furnaces, and soaking-pits, show that the science of combustion is, as a rule, either imperfectly understood or very badly applied by those in charge of the plants. A great deal of heat can, and ought to be, recovered from such waste gases.

Such satisfactory progress is now being made with the electrostatic cleaning of blast-furnace gases, that the day may be confidently anticipated when all the gas (whether required for stoves or engines) will be so cleaned. This will undoubtedly increase the thermal efficiency of the hot-blast stoves, and make a larger surplus of gas available for the steel-works.

Speaking of the utilization of the surplus gas for power purposes, it seems a barbarous practice to burn uncleaned blast-furnace gas in Lancashire boilers, whose efficiency probably does not exceed 55 p.ct., when (if cleaned) its potential energy can be transferred into electric power *via* the gas-engine and dynamo. The day is fast approaching when, in steel-works adjacent to blast-furnaces, all stationary machines (including blowing-engines, cranes, and rolling-mills) will be electrically driven by current generated from the explosion of blast-furnace gas in internal combustion engines. Even now, steam-driven reciprocating blowing-engines should be superseded by electrically driven turbo-blowers.

When such reforms have been carried out in connection with the blast-furnace plants, we may look for the abolition of the gas-producer in the adjacent steel-works—a step much to be desired. The blast-furnace is the place where all the coal on an iron or steel plant should be gasified after it has been carbonized in the coke-ovens.

The problem of fuel economy, as it presents itself to-day, is one rather of scientific organization and co-ordination than of the discovery of new principles. In all the larger works there ought to be an organized staff wholly engaged, under competent direction, in controlling fuel consumption. A group of works in one and the same neighbourhood might well unite in establishing, for their joint benefit, a common fuel laboratory and staff. The British Association Fuel Economy Committee, on whose behalf and in whose name the report speaks, will feel that their work has not been in vain if, as the result of the report, the leaders of the iron and steel industry inaugurate a movement that will not end until the "practical ideals" set before them in it have been achieved.

FUEL CONTROL IN FURNACES.

The object of the first part of a paper presented by Sir ROBERT HADFIELD, Bart., F.R.S., and Mr. R. J. SARJANT, M.Sc., was to discuss from the practical standpoint certain principles underlying the economical use of fuel in metallurgical furnaces, to emphasize the present insufficiency of scientific data for an effective determination of the distribution of heat units in them, and to indicate how far existing data can be applied in developing practical means of detecting and controlling avoidable losses. It was pointed out that with the first desirable essential—that there should be consistent records of the furnace output, the temperatures attained, and the fuel consumption—must be combined an accurate knowledge of the thermal values of the fuel on a cost basis. A table of comparative fuel values was given, drawn up for current prices in Sheffield. From this table, it is evident to what extent certain fuels under prevailing market conditions have a start in the race. The last column of air values was given with the object of showing just what volumes of air are necessary to produce the same quantity of heat from different fuels; for it is necessary to debit against the fuel the waster of heat units in cases in which the air control is not closely watched.

Comparative Fuel Values.

Fuel.	Calorific Value B.Th.U. Gross.	Cost, August, 1919.	Thousand B.Th.U. per 1d. Cost.	Bulk.	Theoretic Volume of Air for Liberation of 1000 B.Th.U. C.Ft. at 15° C.
Coal.	Per Lb.	Per Ton. s. d.		C.Ft. per Ton.	
Anthracite (Welsh) . .	15,000	56 0	50·0	40	10·1
Bituminous hards (York, Derby, and Nottingham coal fields) . .	12,250	34 0	67·3	48	11·0
Bituminous nuts (ditto).	12,250	30 0	76·2	45	11·0
Coke.					
Foundry	13,500	66 3	38·0	65	10·3
Steel melting	13,200	64 0	38·5	70	10·5
Large gas coke . . .	12,900	43 3	55·7	80	10·45
Breeze coke	12,800	47 9	50·0	58	10·5
Liquid Fuel.		Per Gal.			
Petrol	20,000	2 8	4·5	25 9	9·85
Benzol	17,750	2 4	5·6	31·8	9·85
Paraffin	19,950	1 3	10·9	29·7	9·45
Heavy oil (blast-furnace neutral fuel oil) . .	16,000	6½	22·9	33·4	10·3
Gas.	Per C.Ft.	Per 1000 C.Ft.*		Density Relative to Air.	
Town's gas	535	4 0	11·15	0·61	8·3
Water gas	310	11·5	27·0	0·53	7·1
Producer gas	165	4·8	34·4	0·86	7·6

* In a discussion recently before the Engineers' Society of Western Pennsylvania, Mr. A. E. Blake gave an estimate of the cost of blue water gas and producer gas, based on prices prevailing a year ago in America. For large sets he quoted the price per million B.Th.U. produced as 28·91 c. for water gas made in sets provided with waste-heat boilers, and 27·35 c. for producer gas. These figures correspond to a production of 79·1 and 85·6 thousand B.Th.U. per 1d., at present rate of exchange.

ECONOMICAL COMBUSTION.

In dealing with the subject of gaseous fuel in the Presidential Address to the Society of British Gas Industries in 1918, Sir Robert Hadfield drew attention to its economic utilization in industrial heating; and to stimulate investigation and interest in the subject he offered a prize for the best essay on the use of gas in commercial practice. In the essay, which was adjudicated on by the Society of British Gas Industries,* Mr. F. W. Epworth stated that "much waste in the use of gaseous fuel . . . arises largely from lack of knowledge of the principles involved;" and he made one of the objects of his paper to set out the underlying principles which govern its control. Not the least useful of the information he gave was a series of calculations of waste heat values and theoretical calorific intensities of some typical gaseous fuels. Indeed, it was a step in the compilation of data which is needed, but fell short of its best utility in not being presented in graphical form.

In order that the value of such work should not be lost sight of, the authors drew up from some of his tables a graphical chart of theoretical calorific intensities, showing the effect of excess air and the temperatures of regeneration thereon, for three typical gases. This chart accompanied the paper.

Having worked out the heat-balance of the furnace, it is possible to review the thermal economy of the whole furnace in relation to the special metallurgical demands of the process. What the saving is likely to be in any improved control of combustion was indicated by a chart in the paper.

A heat-distribution chart for a number of gas-fired furnaces was given. By means of this chart it has been possible to foreshadow the only changes likely to result in fuel economy. Thus, in the case of the waste heat, the possible saving was only in the region of 5 p.ct. Any reduction of the radiation loss would entail reconstruction of the furnaces in certain respects, or a modification of the metallurgical process. Experiments are being continued in the attempt to make practical use of this information in respect of flame-control and the selection of refractory materials.

Finally the authors emphasized the point that the economical utilization of fuel cannot be brought about in a hurry. It can only be the result of long and patient labour, and the cordial co-operation of all associated with its use.

GENERAL POSITION IN REGARD TO ENERGY SUPPLIES.

In the second part of the paper the authors said that whether the future consideration of our fuel resources is to follow in the direction of a greater application of gaseous fuel or the development of a smokeless fuel together with an increase of the production of fuel oil from coal, or whether a greater proportion of raw

* See JOURNAL, Vol. CXLVI., pp. 755, 804.

PODMORE

Dustproof

Bunsen Burners and Lamps

Domestic & Industrial.

IVEX MANTLES.

"K" INVERTED Burners.

OPAL & FLINT GLOBES.
HEAT RESISTING BOWLS.
MAIN COCKS, UNIONS, and BRASS WORK for Gas-Works Requirements.
SYPHON PUMPS.
FORCE PUMPS.
PRESSURE GAUGES, &c.

A. E. PODMORE, trading as

A. E. PODMORE & Co.

Gas Lighting Patentees, Engineers & Contractors,
34, Charles Street, Hatton Garden,
LONDON, E.C. 1.

Telegrams: "Promerope Smith, London." A.B.C. Code, 5th Ed., used. Telephone: No. 6600 Central.

JOHN YATES & CO. LTD.,

- Aston Manor, -

BIRMINGHAM.

Established 1804.

TELEGRAMS: "Yatonian, Birmingham."
PHONE: Birmingham East 400, 401, and 402.

SEND for Complete Illustrated CATALOGUE

MAKERS OF

BEST QUALITY TOOLS.

Sam! Cutler & Sons Ltd.

Engineers and Contractors

Complete plants for the production of

Coal Gas, Water Gas, Hydrogen Gas.

Poddington Iron Works, Millbank. **London.** 29, Victoria Street, Westminster.

WATER GAS PLANT.

ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

36, Victoria Street, London, S.W.

GASHOLDERS

MILBOURNE PATENT ROLLER CARRIAGES. AUTOMATIC LUBRICATION

PURIFIERS

WITH

MILBOURNE PATENT DUPLEX VALVES, AUTOMATIC COVER FASTENERS, SAFETY DISCHARGE SHOOTS, RUBBER JOINTING. "MILBEL" PATENT PURIFIER GRIDS.

CONDENSERS, SCRUBBERS, AND GAS WORKS PLANT OF EVERY DESCRIPTION.

C. & W. WALKER, LTD., DONNINGTON, NEWPORT—SALOP.

LONDON OFFICE: 110, CANNON STREET, E.C.

COAL TAR AND AMMONIA PRODUCTS.

Benzole, Toluole, Solvent Naphtha, Creosote Oils, Grease Oils, Carbolic Acid, Dark Cresylic Acid, Granulated (Crude) and Sublimed Naphthalene, Anthracene, Refined Tar and Pitch. Sulphate of Ammonia containing a Guaranteed Minimum of 25¼ per cent. Ammonia.

Beta Naphthol, Alpha Naphthylamine, Beta Naphthylamine.

For Prices apply to the SOUTH METROPOLITAN GAS COMPANY,

Telegraphic Address
Inland: "Metrogas, Peck, London."
Foreign: "Metrogas, London."

709, Old Kent Road, LONDON, S.E. 15.

coal is to be directly transformed into electrical energy, the call of the present time seems to be for a broad constructive view of the whole situation to be taken by those responsible for our industrial policy. The directing of conflicting interests in the channels of industrial progress calls for the application of a genius of organization that some of our friends, though not all our enemies, say we do not possess as a nation. It embraces a problem which for the moment is the paramount need of the world at large.

COKE ECONOMY IN CUPOLA PRACTICE.

The following paper was submitted by Mr. H. JAMES YATES on behalf of the British Association Fuel Economy Committee.

Fuel consumption in cupolas is found to depend on several factors. The heat developed is employed in the following manner:

1.—For melting the iron and fluxing the impurities.

2.—For providing the necessary extra heat in the iron to enable it to continue sufficiently fluid to make satisfactory castings while being carried from the cupola to the moulds—often a considerable distance.

3.—To make good the heat losses:
- (*a*) From the casing by radiation.
- (*b*) Due to sensible heat in the waste gases.
- (*c*) Undeveloped heat in the unburned carbonic oxide.

Of these, No. 2 may seem unnecessary to mention apart from No. 1, because, of course, the ultimate object of all cupola melting is to obtain good castings. But it is now mentioned separately because, unless it is taken into consideration, a comparison of results obtained in different foundries is impossible. A foundry making light castings requires much hotter iron than one employed on heavier and rougher work. Similarly, a large foundry requires hotter iron than a small one, on account of the longer transport from the cupola to the moulds. As a consequence, the fuel expenditure per ton of iron melted is bound to be more for the light castings than for the heavy, and more in the case of the large foundry than of the small one. As an example of this, a foundry making both light and heavy castings gave some years ago figures per ton of iron melted at 2 cwt. 2 qrs. 4½ lbs. of coke for the light, and 2 cwt. of coke for the heavy castings.

It will be most convenient to deal first of all with No. 3.

(*a*) *Loss by Radiation.*—As the ratio "surface : capacity" will diminish with increasing diameter, it is advantageous to build wide cupolas, except so far as the diameter is limited by considerations of blast penetration and is determined with due regard to the "diameter : height" mentioned below. This loss by radiation is of small importance compared with losses (*b*) and (*c*).

(*b*) *Sensible Heat in the Waste Gases.*—The gases leaving the combustion zone do so at a high temperature; and the descending charge should be caused to take up as much of their heat as possible, because any heat not so taken up is lost to the cupola. To prevent this loss, it is necessary to have as many contacts as possible, per unit time, between the hot gases and the charge; for this is the condition under which the gases most readily part with their heat. In a high and narrow cupola the path of the gases is longer and their velocity greater; and for this reason such form of cupola is preferable. The ratio "diameter : height" should therefore not fall below a certain minimum. In this connection, it should be noted that the employment of the old-fashioned wasteful cupolas of low and wide form was occasioned by the necessity of keeping the charging-door as near the level of the shop as possible. With the development and adoption of lifts, there is no longer any reason for continuing this practice. In this connection, it is necessary to ensure the avoidance of bad arrangement of the charge or its improper settling in the cupola, both of which allow hot gases to get away without coming properly in contact with the charge, and thus without giving up their heat. This is further mentioned in (*c*).

(*c*) *The Undeveloped Heat due to Unburned Carbonic Oxide.*—There is no need to emphasize the obvious loss of heat when carbonic oxide escapes at the furnace throat. It represents the loss of, roughly, two-thirds the heating value of the carbon consumed in its formation. It is impossible to ensure that no carbonic oxide shall be lost; but any cause tending to increase the amount of the loss should be carefully minimized, or if possible eliminated. Such causes are: (i) Lack of adequate blast; (ii) badly arranged charges owing to irregularities in charging, or to projections in the lining upsetting the proper settling of the charge, thus allowing, in greater quantity, air to make its way up one part of the furnace than another; or (iii) improper distribution of the air at the tuyeres with the same result as in (ii), and possibly with the further result that the carbonic oxide is not burned, owing to its being already cooled below the ignition temperature before it receives the air that is necessary for further combustion.

Dealing with Nos. 1 and 2, there are certain points in cupola construction the effect of which has to be considered.

Tuyeres.—Much time and thought have been given to the number, position, and shape of the tuyeres. It is often found that, on investigation, the results obtained by special shapes, &c., do not justify the hopes of their introducers. The general principle which emerges from the various claims made appears to be only that sufficient area of tuyere must be provided, and that, as long as the ratio "tuyere-area : cupola-area" is about a certain figure, the results obtained with one or more rows of tuyeres one above another yield no advantage in the ordinary way, provided at least four to six tuyeres are used. The advantage of more than one row appears to be simply that, in case the capacity of the cupola is increased by reducing the thickness of lining, the necessary increased supply of air can be provided for the heavier output.

Furnace Shape.—The usual shapes are (1) those of equal diameter all the way from base-plate to charging-door; (2) those with smaller diameter from base-plate to a certain distance above the tuyeres. For small cupolas, there does not appear to be a great deal to choose between these shapes. In large cupolas, however, the second shape appears to be the better for several reasons, viz.—the coke bed is smaller. The blast can get more easily to the centre. The hot gases ascending from the combustion zone are better distributed in the furnace, and less likely to make their way up the sides of the charge.

Manipulation.—Charging is done in layers starting from the bed, which must extend 18 in. to 24 in. above the tuyeres. Above this in rotation are placed pig, scrap, coke, and limestone. It is necessary to find by experiment the correct weights for the most economical working. As the bed is necessarily about the same weight whatever the length of blow, it follows that it is more economical to run longer blows than shorter ones. The coke charges should be just sufficient to bring the bed to its former level after melting the previous iron charge. Experiments may with advantage be made in reducing the coke charge till the best results are obtained, as an excess of coke not only reduces the economy of the furnace generally, but also the speed and regularity of melting in particular.

Use of Kindling Tuyeres.—In many foundries the practice is to reject the first iron because of its being too cold. This waste may be eliminated by the use of a kindling tuyere placed low down near the sand bottom. This heats-up the coke so that the first few hundredweight of iron is not chilled. After a bogie or so of iron has been drawn off, the kindling tuyere is shut-off and plugged.

To put the matter briefly, there are four distinct advantages gained by using such kindling tuyeres—namely:

(*a*) Hotter iron is obtained at the beginning, owing to its having to pass through a deeper bed of glowing hot coke. When the kindling tuyere is used properly, all the coke from the bottom up to the melting zone is at white melting heat. The iron on passing through this gathers heat all the way down on its progress to the tapping-hole. On account of the clean condition of the cupola at this stage, the iron is probably hotter than any which may be run at any later stage during the day. When the kindling tuyere is not used, only the part of the coke bed above the ordinary tuyere is at white heat, and the part of the bed between the tuyere and the bottom is comparatively cold. The iron on its way down through the bed gathers heat until it reaches the tuyere, after which it has to give up heat to the colder part of the coke-bed. Under these conditions, the first iron melted reaches the bottom almost too cold to run, and certainly too dull for any but heavy castings.

(*b*) The iron being hotter from the first, gives cleaner and better tapping-holes, and removes the risk of iron solidifying in them. The condition known in the trade as at "iron hole" is much dreaded by the furnacemen. The iron plugs formed in the holes have to be driven out; and in doing this, the clay may be cracked and broken, and the holes made too large. When this happens, it is difficult, if not impossible, to keep back the slag; and as the slag is usually basic in character, it fluxes-out the holes, and there is a danger of the whole front being melted-out.

(*c*) Another advantage of using a kindling tuyere is that, when the ordinary tuyeres are put to work, they start blowing on coke heated to a very high temperature, and are not so likely to blow cold and form the long "snouts" or projections which so often give trouble by preventing the coke from getting near the tuyeres—a condition which invariably results in "bridging," and the production of cold iron.

(*d*) In many cupolas the bottom is so cold and damp that the first iron is chilled and the carbon is arrested in cooling, with the result that the castings have a surface lining of white iron, and are quite useless for machining or filing. Such castings might readily destroy or damage expensive tools. When the kindling tuyere is used, the bottom and sides of the cupola, as well as the coke-bed, are so thoroughly heated that the danger of producing white hard iron is completely removed. A nice grey soft iron, easily filed and machined, can be run at the first as well as at any time of the cast, if this method is applied.

It is a good plan to reduce the blast pressure and the charge of coke near the end of the blow. This saves coke, and also the linings, which latter are often badly damaged towards the end of the blow.

CONSUMPTION OF COKE AND OUTPUT.

The following particulars give the results obtained with a furnace—one of several—the records of which have been drawn upon over a period of fifteen years. In 1901 the average output given was 7·5 tons per hour, with a consumption of 2 cwt. 2 qrs. 6½ lbs. of coke per ton. Gradually this was improved, until in 1912 the

output was 10·8 tons per hour, for a consumption of 1 cwt. 2 qrs. 23 lbs. of coke per ton.

At a later period, to increase this output, the diameter, both at the charging-door and at the tuyeres, was increased, as was also the tuyere area. The result was an output of 14·3 tons per hour, with a coke consumption of 1 cwt. 3 qrs. 16 lbs. per ton of iron. Subsequently, when this rate of output was reduced to 12·8 tons per hour, the coke consumption fell to 1 cwt. 3 qrs. 4 lbs. per ton. This appears to show that for every cupola there is a certain output per hour at which maximum economy in coke consumption is attained. It may be stated that, while any increase of output beyond this is obtained only with an increased coke consumption per ton, yet it may pay to "force" the cupola to give such an increased output rather than build a small cupola as an auxiliary. This is illustrated by reference to the case of a small cupola in which, with an output of 3·12 tons per hour, the coke consumption was as high as 2 tons 3 qrs. per ton of iron melted.

It must be distinctly understood that the foregoing figures apply exclusively to cupolas engaged on light castings, mainly from $\frac{1}{8}$ in. to $\frac{5}{16}$ in. thick. Many thousands of these are only of a weight of $2\frac{1}{2}$ lbs. per square foot; and the total number of such castings amounts to a good seven figures per annum. Further, these cupolas are only run continuously for the afternoon; whereas a whole day's run each time would doubtless reduce somewhat the rate of coke per ton of iron.

Turning to heavy castings, it is much more difficult to get regular figures, because foundries usually engaged on heavy work also make much lighter castings as well, and their records are accordingly difficult to analyze. In general, the consumption of coke per ton of iron melted varies from—for exceptionally heavy work—1 cwt. 2 qrs. to 3 cwt. 3 qrs. where the castings vary considerably in weight.

Generally, it may be safely stated that in large foundries doing mixed work (as most of them have to) the average consumption of coke approximates nearly 2 cwt. per ton of iron. It is but seldom that such regular working on one particular class of castings is found as that quoted above for those cupolas doing light castings.

The cupolas engaged on light castings, and mentioned in the foregoing, show the following ratios:

Area at tuyeres.									
Area of tuyeres	4·3	..		5·4	..		5·8		
Height from tuyeres to charging door.									
Diameter at tuyeres	3·8	..		2·8	..		5·3		
Iron.									
Hours of blast (tons)	10·8	..		14·3	..		3·12		
	Cwt.	qrs.	lbs.	Cwt.	qrs.	lbs.	Cwt.	qrs.	lbs.
Total coke	1	2	23	1	3	16	2	0	3

ROLE OF THE LARGE GAS-ENGINE.

A report submitted by Mr. COSMO JOHNS and Mr. LAWRENCE ENNIS dealt with the present status of fuel economy in the German Iron and Steel Industry of the occupied territory on the left bank of the Rhine. The authors found evidence in every place they visited that the importance of the efficient cleaning of the gas was fully realized; and they remark that effective cleaning begins after the gas leaves the ordinary dust-catcher. The following section, on the "Rôle of the Large Gas-Engine," is extracted from the report.

Nothing that we saw during our visit was more suggestive or instructive than the use made of large gas-engines. The big central stations with ten, twelve, or more gas-engines of from 1500 to 5000 H.P. visited at so many works were eloquent testimony to the value of the internal combustion engine for the utilization of fuel gas. Blowing-engines for the blast-furnaces, for the Bessemer converters, and for the generation of electric power, were nearly always gas-driven. The more modern the works, the more were large gas-engines used. For the units favoured in iron and steel works for blowing-engines or electric generators, the gas-engine is not only the most efficient, but it uses the fuel gas that is normally and necessarily produced by the blast-furnace—a fuel on which the only real cost incurred is that for collecting and cleaning it. Starting with the cleaned gas, the alternatives are steam-raising and using the steam in turbines, or using the gas in internal combustion engines. Here the overall efficiency from fuel to power generated is greatly in favour of the gas-engine.

The large installations in nearly every works we visited were convincing proof that the large gas-engine using cleaned blast-furnace gas was a reliable prime-mover. The table shows the installations of large gas-engines at work. It is by the fullest possible use of blast-furnace gas in large gas-engines for the compression of air for blast-furnaces and Bessemer converters, and the generation of electric energy for transmission to rolling-mills and other steel-works plant, that fuel economy can best be secured; for in this way, and this way only, can a considerable surplus of gas be obtained for such steam-raising as may be found necessary, and for furnace-heating.

This was the policy of the works we visited; and the more modern the works, or the more recent its reorganization (if an old one) the more completely was it carried out. Yet the large gas-engine did not suffice to meet all the demands made upon it. It was excellent as a blowing-engine either at half an atmosphere for the furnaces or two-and-a-half atmospheres for the converters; but the gas-driven electric generators do not respond to the fluctuating demands from the steel-works, and the usual practice was to install some steam-turbine-driven generators to assist the gas-driven generators, and in this way form an elastic combination.

But the gas-engine was the predominant partner; and it was interesting to note, as a sign of what we may expect in the near future, that at the Volkingen works in the Saar Valley a waste-heat boiler had been installed to utilize the sensible heat of the exhaust gas of a 3000 H.P. gas-engine. So successful had been its performance (said to be 13 cubic metres of water evaporated at fifteen atmospheres pressure with considerable superheat), that a second boiler was being put down. Attention has been directed by both Prof. Bone and Sir Dugald Clerk to the fact that the gas-engine, in addition to its high efficiency as a heat-engine, still rejects in its exhaust gases a considerable proportion of the heat of combustion of the fuel it consumes. The example we saw of the successful utilization of this waste heat in the immediate vicinity of the power-house where the turbines were installed, was convincing evidence that effective use can be made of the heat in the waste gases from large gas-engines. If at the same time the cooling water of the gas-engine be used as feed-water for the waste-heat boiler, we should have a combined efficiency unapproached by any other prime-mover. That this is the direction in which further economy in the consumption of fuel can be obtained is clear from the general principles involved and the examples we have cited.

The more the gas-engine can be utilized for power and blast production, and the less the call on gas or coal fired boilers, the greater will be the economy measured in fuel consumption—from ore to finished steel—per ton of product; for it would follow as a consequence that more blast-furnace gas would be available for furnace heating in the steel-works.

Examples of Installations of Large Gas-Engines.

Works.	Number of Blast-Furnaces.	Gas Driven.			Steam Plants.
		Blast Furnace Blowing-Engines	Converter Blowing-Engines	Electric Generators.	
Hagondage.	6	6 of 1500 H.P. each	2 of 5000 H.P. each	12 of 2500 to 3000 KW. each	Additional in all cases.
Knutange .	10	9 of 2000 H.P. each	2 of 5000 H.P. each	3 of 2800 KW. each; 2 of 1100 KW. each	
Rombas .	6	8 of 2000 H.P. each	1 of 6000 H.P. each; 2 of 4000 H.P. each	3 of 400 KW. each	
Differdange	10	8 of 14,000 H.P. total	..	12 of 20,000 KW. total	
Adolf Emil Hütte.	6	8 of 1400 c.m. air capacity each	..	9 of 1400 to 1500 KW. each	

DISCUSSION.

Sir ROBERT HADFIELD said he had received a letter from Sir George Beilby regretting his inability to be present, as he was in Birmingham representing the Royal Society in connection with the "James Watt Centenary."

Mr. BENJAMIN TALBOT said it was in 1904 that his first gas-engines came over from Seraing. Seven of them were put in—they were among the first in this country; but the whole of them were scrapped before the war. A second type came, and was installed before the war. But this was broken up; and he was now engaged in installing a third series, which they had every reason to believe would be more satisfactory than the first. The papers were all based on the fact that the prime-mover in iron and steel works was to be the gas-engine. He agreed with this view; and in the ideal steel works plant which he had outlined in the Coal Conservation Committee's report he had looked to the use of blast-furnace gas for this purpose to the fullest possible extent. If means could be found to clean it, he would rather deal with blast-furnace gas than with coke-oven gas.

Mr. C. TENNYSON, a Director of the Federation of British Industries, explained in a little more detail than Sir Robert Hadfield the intended operations of the Fuel Economy Committee of that body. The scheme included sending round experts on request to investigate the conditions of many particular trades as regards fuel economy. It would then be seen to what extent the particular industry fell short of a desired standard. In this way he believed great good could be done.

Mr. W. H. HEWLETT said that one of the factors in connection with the greater use of gas-engines was to have an effectual means to clean the blast-furnace gas. Mr. Talbot had had to scrap his engines twice already; and this was one of the things to be considered.

Prof. H. E. ARMSTRONG, after referring to early papers of his own before the Institute, on the combustion of coal, said that very little progress had been made in this direction. There had been a good deal done privately; but there had been no systematic research on the matter. In 1885, he nearly persuaded Dr. Mond to take the subject up systematically. Unfortunately, he took up the gas producer instead; but had he taken up the subject of the carbonization of coal, he believed the position to-day would have been a very different one as regards the production of oil from coal, at all events. He believed the iron and steel industry had made the only real step forward in regard to the distillation of coal and producing coke for its own use and in developing the recovery plant; and he wished to point out in the first instance how important a part this industry was likely to play in

the future in providing the coal-tar materials which were so often spoken of in connection with the over-discussed dyestuff industry. What use was going to be made of the gas was another question. The substances which were required for the dye industry were high-temperature products—they were not to be got by low-temperature distillation; and he believed the iron and steel industry was going to be the only high-temperature coking industry at no very distant date. The gas industry as it was to-day must be reformed—it must adopt Lord Fisher's advice to "scrap the lot," and introduce an entirely new method akin to that of supplying gas from coke-ovens and blast-furnaces. Wherever there were coke-ovens, the iron and steel industry should take on the gas supply—there ought not to be a gas company heard of anywhere near a blast-furnace. From this point of view, he thought the development of high-temperature coke production was of very great importance indeed; and it was to be hoped that, by fair means or foul, the oven which did not recover bye-products would be got rid of at a very early date. This was one of the things which the Iron and Steel Institute ought to set itself to do. Then he was brought on, necessarily, to deal with the gas industry and the production of oil from coal. He had said that he thought the gas industry ought to be scrapped as it existed at the present time as a separate industry. To produce gas of the quality required by the distillation of coal must soon be regarded as an impossibility. They could not distil enough coal to produce gas of sufficiently high quality without producing a large amount of very poor coke which nobody wanted to use; and it was not available for iron and steel purposes. Moreover, it was quite unsuitable for domestic purposes, because it was too hard and burned with such difficulty. Therefore, the gas industry must alter in one of two directions. It must develop in such a way that it made use of a much smaller amount of coal, and did not produce coke at all, or that it must be developed as a dependent industry in connection with another, such as the electrical industry or the new industry which they had got to develop for the production of smokeless fuel for domestic use. In this way they should get a large amount of oil in the aggregate and a considerable quantity of high quality gas for disposal, which could be employed for domestic purposes generally. There would also be a very large amount of smokeless fuel produced, which could be used partly for domestic purposes (if of sufficiently good quality), and the rest at once charged into converters and made into fuel gas—nitrogen being recovered in this way. So that what they had to look forward to, outside the iron and steel industry, was a complete change in the methods of using coal. He had often said of late years that the Government ought, at a very early date, to give notice that they would not allow coal to be burned (after a certain number of years) for domestic or industrial purposes; and he now ventured to urge this again. If they were going to deal with the matter at all deliberately, with forethought, they must make up their minds to copy the French and arrange to legislate ahead. He urged that they should proceed with much greater caution than appeared likely in regard to erecting the large central power stations which were proposed. Listening to the various discussions, and reading what had been written on the subject, he could not help feeling that the question was in no way so definitely settled as the Coal Conservation Committee's report would have them suppose. It seemed to him desirable that at the very earliest date one or two of these great central power stations should be put into operation for the purpose of gaining experience—not to proceed at once to convert some 600 stations into the 16 large stations which had been recommended. He pleaded also, at the same time, that some great centre should be taken, and a combined scheme set in operation in which the gas interests, the electrical interests, and the fuel production interests should be forced to work together. He would even suggest that Nottingham should be taken as a convenient town for the purpose. Unless two or three public experiments of this kind were made, they would simply dawdle on for many years before arriving at any definite result. Prof. Bone had referred to the need for scientific control of fuel in various sorts of works. It was a remarkable thing that this subject of fuel management had not caught on more in this country than it had done of late years. He knew of only one firm which had a separate fuel manager—that was Crosfield's, of Warrington. They had a man whose whole and sole care it was to go about the works and see how coal was being used, and seeing that it was used to advantage. He knew, as a matter of fact, that this had been a source of great economy to them. It was remarkable that so few firms had a man of this kind. Men of this type had to be educated, which was not going to be an easy matter. Prof. Bone's success in this respect had been very great. The opportunities for educating these men at the present time, however, were not sufficient. A very large number would not be needed; but such schools as there were should be made very efficient, and have full opportunities for training their men. In a very significant passage in the report to the British Association, Prof. Bone had complained that he had been cold-shouldered by the Fuel Research Board and the Advisory Committee for Scientific Research. He wished to repeat the challenge that he threw out to Sir George Beilby at Bournemouth. Sir Charles Parsons had assured them at Bournemouth that great progress was being made, and that nearly a quarter of a million had been spent. What he wanted to know was, was Sir George Beilby justified in spending this amount of money—had he any properly thought-out programme of work? The iron and steel industry was distinguished by the way in which it did not keep matters secret; and the Fuel Research Board must set aside the secrecy which it was practising. He challenged Sir George Beilby to reconsider the policy of his Committee, and to place all his cards on the table. All they knew was that the Committee had cold-shouldered everybody, had told them nothing, and would ask nobody anything. He believed that Prof. Bone was engaged as Consultant by the Advisory Committee; but he was then side-tracked and prevented from being consulted. They objected, as a scientific body, to the policy of secrecy on the part of a Government Committee. No policy could be a worse one. There was the clearest evidence that the money was not being properly spent. He challenged Sir George Beilby to reconsider the policy of the Board. It had been put forward over and over again that the desire was to prevent overlapping; but he argued that in the matter of scientific research overlapping should be encouraged on every possible occasion. They had been told that the Fuel Research Board was going to investigate the whole question of coal distillation. He wished to raise the question as to whether this was a subject for a Government body to undertake at all. He regretted that Sir George Beilby was not present, as he would have liked an answer to some of these questions; and he would have been only too glad to have gone further into the matter in his presence.

Sir ROBERT HADFIELD said he had recently received an interesting batch of information from the Steere Engineering Company—gas engineers and builders of Detroit, Michigan. In this he noticed a useful apparatus termed a "Tar Camera for Calorimetric Tar Determination." He did not know whether anything had been done on this side of the Atlantic in this direction; but it certainly seemed to open up the use of a valuable control instrument in gas-works and works where bye-product recovery or gas cleaning for power purposes was operated. Tar pictures were obtained on a special white paper through which a certain amount of gas had been drawn. The tar carried by the gas left a characteristic stain on the paper; and the amount could be determined either by comparison with a standard paper, or still more accurately by weighing the paper before and after taking the picture. The camera itself was made entirely of aluminium, including the cock—this metal not corroding or being affected by any constituents of the gas. The method, of course, depended largely on the observer's skill and ability in comparing the colour shades. It was not reliable when the amount of tar was so great that the paper no longer showed through. The latter condition was reached when a 1 ft. sample contained about 50 milligrammes of tar—equivalent to about 110 million pounds per million cubic feet. If the amount of tar in the gas exceeded this figure, it was then best to take a small sample of one-half or one-fifth cubic foot for comparison. On the other hand, it was difficult to estimate extremely small amounts of tar by this method, except by taking larger samples of 10 c.ft. It might be interesting to state that 2 milligrammes of tar in a 1 c.ft. sample, which was equivalent to 4·4 lbs. per million, would leave a very light stain on the paper. The quantity of tar carried by gas varied from about 800 lbs. per million cubic feet (this being equivalent to 5·6 grains, or 362·8 milligrammes, per 100 cubic feet) down to absolutely clean gas. He should add that these calorimetric tests were not designed for accurate quantitative results—their value was rather comparative. Nevertheless, it was a very useful test. [Sir Robert exhibited some photostat copies of the Steere calorimetric charts.]

Prof. HENRY LOUIS remarked that it had struck him as peculiar that in this discussion nobody had attempted to define what was meant by "fuel economy." By fuel economy might be meant getting out the maximum number of heat units in the fuel, or getting out the maximum number of available bye-products, together with the heat units. Again, it might mean getting the maximum commercial result. The question had close relation to the cost of the necessary plant to effect such commercial results. He would like to know if Mr. Johns was as clear in his own mind as the paper would lead them to believe that the best gas-engine in the future was the one using blast-furnace gas. Personally, he was inclined to believe that the best gas-engine would be one using a mixture of blast-furnace and coke-oven gas. He had not the least doubt that the gas-engine using blast-furnace gas was thermally a very efficient machine. But was it economical? When using a low-grade gas, it was necessary to have a much more expensive engine; and from the commercial point of view might it not be more economical to use a less expensive engine and an enriched gas? He did not think there were sufficient data at present available to support Mr. Cosmo Johns' view.

Mr. H. M. RIDGE said that experiments were now being carried out which led to the belief that a very much cheaper form of gas-cleaning apparatus would be available than the electrostatic method, which was now regarded as the only workable one.

Mr. FRANK FOSTER said that he had probably had as much as anybody to do with the development of the large gas-engine in Great Britain; and he could say that there was no need for hesitation on the score of reliability. The gas-engine was one of those things which, if it was not made well, should not be made at all, or they were courting disaster. Therefore, anybody who wished to buy a gas-engine should satisfy himself that the firm who made it understood the engineering side, the foundry side, the design side, and the making of it.

Mr. T. H. BAILEY said there was no doubt that gas was a cheaper form of power than steam. At the Littleton Collieries, gas plant had replaced steam plant for generating electricity and the relative consumption of coal for the same work done was 2½ tons, as against 9 tons with steam plant.

Mr. W. H. PATCHELL, speaking upon large engines at iron and steel works, said he was familiar with what had been done at Saarbrucken, Westphalia, and Belgium. On his visits there he had been impressed in the early days with the number of cracked cylinders. But it was necessary to appreciate that the engines were put in to deal with waste fuel; and although a certain amount of money was wasted in engines, the waste power was utilized, and valuable experience was gained. The multi-cylinder engine had been developed in this country; but he, for one, was confident that the large cylinder engine would still have its day. With regard to the large electric power schemes, although everybody admired the commercial acumen with which the electric power supply in the North-East coast had been developed, that area was more or less an ideal one; and the country was at the present time being asked to swallow figures which had never been seen, and to base on this the electrification of the whole country in sixteen areas. Who could say, however, that the policy which had been best for the North-East coast would be best for the whole country? He would rather see a large number of plants with facilities for interconnection of large works by giving private owners a proper chance to do this. At the present moment anybody could carry coal over public roads; but an Act of Parliament must be obtained to lay a cable under a road to carry a much larger quantity of power.

Mr. HENRY CROWE, referring to the gas-engines which had been scrapped by Mr. Talbot, said that he put in some at his works nine years ago; and they were as modern to-day as they were then. There was practically no difference, except in regard to a few details.

The authors will reply to the discussion in writing.

EFFECT OF CARBON DIOXIDE ON EXPLOSION PHENOMENA.

There appeared in the issue of "Engineering" for the 5th inst. an article by Major W. T. David, M.A., Assoc.M.Inst.C.E., in which he gives the results of some experiments not previously published, but which he remarks are of considerable interest, as indicating the kind of influence that products of combustion when mixed with the working fluid in the cylinder of an internal combustion engine have upon working pressures and heat loss to the walls of the cylinder. The article is upon the "Effect of Carbon Dioxide when Present in Inflammable Gaseous Mixtures on Explosion Phenomena;" and the experiments were originally made to discover whether the presence of a gas like carbon dioxide (which absorbs radiation of the wave-lengths emitted by an exploded mixture of coal gas and air) had any influence in reducing the large heat loss due to radiation from the mass of the hot gaseous mixture. As a matter of fact, the radiation loss was considerably reduced; but on analysis the reduction was found to be due entirely to the lower temperatures developed in these mixtures. Indeed, had the temperatures not been reduced owing to the presence of carbon dioxide, the radiation emitted would have been greater than from the coal-gas and air mixtures.

A number of curves and tables accompany the description of the experiments, which Major David says show clearly that inflammable mixtures of coal-gas and oxygen produce far lower pressures on explosion when they are mixed with carbon dioxide than when they are mixed with nitrogen as a diluting gas. They also show that carbon dioxide has a marked influence in slowing-down the rate of combustion. It is extremely probable that the carbon dioxide slows-down the rate of burning to such an extent that a considerable fraction is still unburnt at the moment of maximum pressure (at any rate, when carbon dioxide is present in large quantities). This, in conjunction with the high volumetric heat of carbon dioxide at high temperatures, appears to be mainly responsible for the lower pressures produced in the carbon dioxide mixtures. The experiments seem to indicate the importance of reducing to a minimum the proportion of products of combustion in the charge of an internal-combustion engine. This is all the more important in the case of an engine worked on mixtures of moderate strength.

Finally, Major David contends that the experiments indicate that the vibratory degrees of freedom of the inert carbon dioxide molecules very rapidly absorb energy from the freshly-formed molecules which are known to possess at the moment of formation a considerable excess of vibratory energy over and above the amount which they would possess under equilibrium conditions corresponding to the gas temperature. Probably energy is given to the vibratory degrees of freedom of the inert carbon dioxide molecules during collision with the freshly-formed molecules as well as by the absorption of radiation emitted by these molecules. Such a hypothesis would throw considerable light on the reasons for the slower rate of development of pressure in the gaseous mixtures diluted with carbon dioxide.

War Service Charcoal Making in Gas-Works.

The service rendered during the war in the way of carbonizing charcoal for gas masks, at the Potrero plant of the Pacific Gas and Electric Company, has been related by Captain W. E. Brophy in the "Pacific Service Magazine." The charcoal required was of a special kind; and not all classes of carbonaceous materials could be used, as the resulting product must possess infinitesimal pores, thereby presenting a large surface for contact with toxic gases. Such materials as nut shells and fruit stones provided the most satisfactory charcoal for gas defence purposes; and in May, 1918, it was decided, owing to the quantity of fruit grown there, to establish a charcoal producing plant in California. At that time, the Chemical Warfare Service was operating only one charcoal producing plant, which was located in Astoria, Long Island, on the property of the Consolidated Gas Company of New York. The initial carbonization of raw materials was carried out at Astoria in horizontal gas-retorts; and so many retorts had been commandeered for the purpose, that the gas-manufacturing capacity of the Astoria plant was seriously impaired. The Independent Gas-Works, a stand-by plant of the Pacific Gas and Electric Company, was found to be adaptable to the manufacture of charcoal; and from the beginning of August until the early days of December, the plant was in continuous operation. During this period, 3,223,148 lbs. of charcoal were manufactured. When drawn from the retorts, the charcoal was allowed to remain on the ground for from 24 to 48 hours, to permit it to dry, and to observe any danger of spontaneous combustion. It was then placed in storage hoppers for a further number of days; regular temperature measurements being taken to guard against spontaneous combustion.

There is to be a visit by members of the Midland Section of the Coke-Oven Managers' Association next Saturday to the Chesterfield works of the Bryan Donkin Company, Ltd., where luncheon will be provided; and in the afternoon, under the direction of Mr. J. W. Lee, the bye-product coking plant of the Hasland Coking Company will be inspected.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Super Gas-Refiners at Work.

SIR,—I have read with much pleasure and interest the article in this week's "JOURNAL" on "The Super Gas-Refiners at Work." The writer of it does well to criticize the Committee's report.

It appears to me that, though in most instances the Fuel Economy Committee of the British Association is formed of men highly qualified in one direction or another, they are far too apt to accept all that Prof. Bone says as "gospel;" and it is so easy for him to make out a strong case when speaking on such questions as inerts, carbon monoxide, sulphur, &c., in coal gas.

The "JOURNAL" note of the discussion on the report was not, I think, taken by one of its own staff, or he would have quoted at greater length Mr. Stromeyer's remarks, who, *inter alia*, spoke as follows (see "Daily Telegraph," Sept. 15):

> At Bradford £30,000 to £40,000 was spent in electrifying works; and they found they were spending more for power and heating than they had done before. As a result, the whole of the electricity had to be taken out of the works.

Our old enemy, Prof. Armstrong, was in my judgment in a more horrid humour than usual, and was particularly severe on Sir George Beilby, and the Fuel Research Board generally, although Sir Charles Parsons, the President of the Association and a member of the Fuel Research Board was in the room. He did not, however, say, as reported in the "JOURNAL," "that gas needed 150,000,000 tons of coal." He spoke of capital. In his opinion, the industry is doomed unless it adopts low-temperature carbonization.

Alas! we are living in an age in which the critical faculties are enormously stronger than the constructive faculties.

The report, it will be seen, was backed by Mr. Evans, of the South Metropolitan Gas Company; while Mr. D. H. Helps, representing the Institution of Gas Engineers, dissented from certain conclusions.

An outstanding feature of the discussion was that, when any speaker condemned the Government's electrical scheme, there was a chorus of "Hear, Hear" from the audience.

UNRESTRICTED PROGRESS.

Sept. 20, 1919.

REGISTER OF PATENTS.

Gas-Analyzing Apparatus.—No. 118,112.

AKTIEBOLAGET INGENIÖRSFIRMA FRITZ EGNELL, of Stockholm.

No. 12,483; July 31, 1918. Convention date, July 31, 1917.

This invention relates to apparatus in which the gas (or its constituents) is chemically or mechanically changed, or in which one constituent (or more than one) is separated from a gas mixture, or the temperature, or the percentage of humidity, is to be changed, or to gas-analyzing apparatus serving any other similar purpose.

It has heretofore been proposed in such apparatus to provide a non-return valve between a mechanically actuated pump and the absorption vessel in which the valve is arranged. It has also been proposed in other apparatus to provide a non-return valve in the piping in front of the gas-measuring bell which is arranged to telescope into the absorption. But according to the present invention, means are provided which permit of the flow of gas or liquid in opposite directions, but at a reduced speed in one direction. This is effected by inserting a device, in a part of the piping suitable for the purpose, forming a resistance or partial resistance to the gas-flow or flow of liquid in one of the two directions of flow. By this means the time necessary for changing the composition of the gas, or its constituents, is gained. The device is preferably arranged in such a place that the gas will reach the primary measuring vessel after having passed the device.

Gas-Analyzing Apparatus.—No. 118,114.

AKTIEBOLAGET INGENIÖRSFIRMA FRITZ EGNELL, of Stockholm.

No. 12,588; Aug. 1, 1918. Convention date, Aug. 1, 1917.

This invention relates to gas-analyzing apparatus worked by pressure above or below atmospheric, and in which (during the operation) the movement of a valve or cock is intended to take place, so as to enable two or more analyses of different kinds to be carried out successively and alternately.

The invention consists in the action being effected by means of the changing pressure of a pumping device or the pressure in the conduit leading to the primary measuring vessel. Piping—preferably in parallel with the pressure pipe connecting with the apparatus—leads to a chamber where the pressure is caused to effect motion, which is then utilized for effecting the desired action.

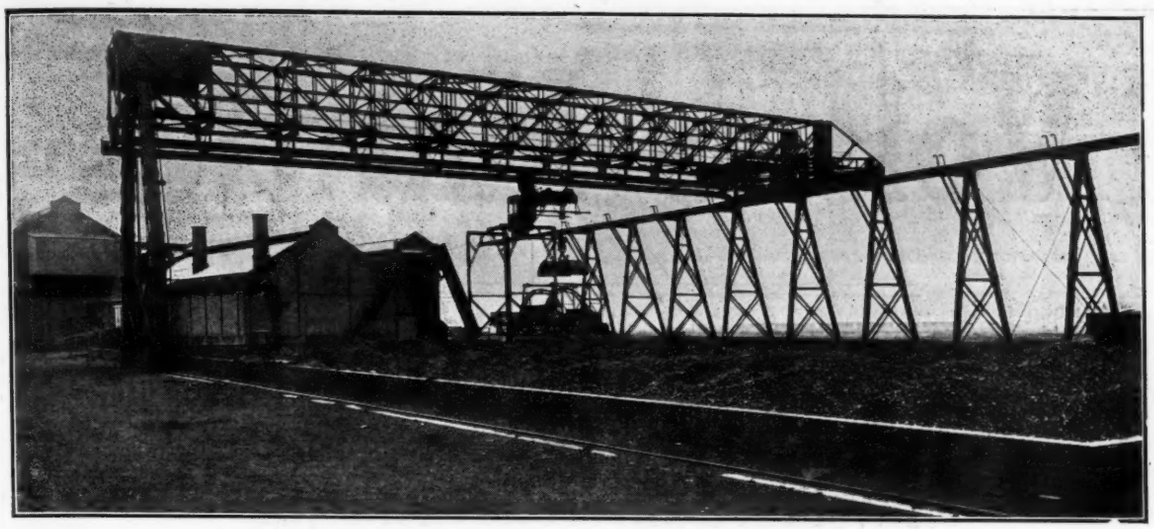
In apparatus by means of which two or more analyses of different kinds are to be effected, a cock or valve is used which alternately connects the pumping device to one or other gas-analyzing apparatus, and which is operated by a piston movable in a cylinder connected with the pressure pipe leading to the pump.

Gas-Fired Furnaces.—No. 130,475.

SMEETON-WRIGHT FURNACES, LTD., FLETCHER, J. E., and WRIGHT, T., of Victoria Street, Westminster.

No. 12,599; Aug. 1, 1918.

This invention relates to furnaces for heating steel, iron, &c., of the type in which separate supplies of gas and air are introduced into the crown of the furnace and mix as they are directed downwardly into



TRAVELLING TELPHER TRACK

FOR HANDLING COAL & COKE OVER EXTENSIVE AREAS—
ANY POINT CAN BE REACHED BY THE TELPHER
& GRAB—HAND TRIMMING IS ENTIRELY DISPENSED WITH.

THE ABOVE PLANT HAS BEEN IN SUCCESSFUL OPERATION FOR 2 YEARS.

STRACHAN & HENSHAW, LTD.

TELEPHONE 432. TELEGRAMS, "STRASHAW." BRISTOL.

Gas Plant and all constructional Steel and Iron Work.

Specialists in Slot Meters, Ordinary Meters, Wet & Dry.

WILLEY & CO., LTD., ENGINEERS,

EXETER, LONDON,
MANCHESTER,
LEICESTER.

The Pioneers of Slot Installations.

Gas Fires.

Gas Fittings.

Gas Cookers.

PICKERING'S VALVE. LIVESEY WASHERS.

Telegrams:
"WILLEY, EXETER."
"GASVILLADO, KINLAND, LONDON."
"METERS, LEICESTER."
"WILMETER, MANCHESTER."
Telephone Nos.:
132 EXETER
224 DALSTON, LONDON.
4777 LEICESTER.
7419 CITY, MANCHESTER.

NOTE ADDRESSES.

Head Offices: **EXETER.**
London Works and Offices:
89-95, HERTFORD ROAD, KINGSLAND, N.
5, Oxendon Street, LEICESTER.
John Street, Booth Street West, MANCHESTER, S.W.

Volker Mantles

Do not buy cheap Foreign mantles, which bring nothing but discredit on the gas with which they are used. It pays to buy a good article. It pays to buy British Mantles. Volker Mantles are British throughout.

The VOLKER LIGHTING CORPORATION, Ltd.
Garratt Lane, ——— LONDON, S.W. 18.

Are All British

SAWER & PURVES,

THE POSITIVE DRY PREPAYMENT METER

MANCHESTER & NOTTINGHAM.

the furnace; and it refers more especially to the burners for use in such furnaces.

Instead of employing fixed perforated bricks or blocks as burners, separate burner nozzles are provided, more especially in the upper or intermediate arch of the crown; the nozzles being supported in an angularly adjustable manner, so as to maintain good alignment in spite of the relative expansion and contraction between the different arches. In the preferred construction, the nozzles are formed with flanges having spherical surfaces resting in corresponding seatings at the upper edgings of the apertures in the crown. In the lower wall or arch of the crown, through which gas and air mixture is projected into the furnace, fixed burner blocks may be employed provided with suitably formed apertures, or separate mixture burner nozzles may also be fitted; the upper nozzles being preferably guided at their lower ends by lugs on the upper end of the lower nozzles or blocks.

Distillation of Coal.—No. 131,409.

TOOGOOD, H. J., and ROBERT DEMPSTER & SONS, Ltd., of Elland.

No. 11,610; July 16, 1918.

The patentees remark that, in intermittent vertical retort practice, the charge has first been distilled for the production of coal gas, and the resulting incandescent coke has, towards the end of straight coal gas distillation, been steamed for the production of water gas, which water gas, in its upward passage through the coke, liberated volatile residues left in the core of the charge and in the interstices of the coke. In patent No. 28,201 of 1908, it was proposed to couple intermittent retorts in widely different stages of carbonization in such manner that the lean gases coming off the nearly spent coke should traverse the newly-charged coal in another retort, or *vice versâ*, whereby the yield of gas would be increased both volumetrically and in total qualitatively as regards the heat units contained in the gas yielded.

The objects of their present invention are to combine and improve the above processes as applied to intermittent vertical retorts, and to render the process thus developed applicable also to horizontal and inclined retorts, so that "coal may be conserved and carbonizing efficiencies enhanced." It has already been proved successful in vertical retorts that steam should be admitted to incandescent coke in which the process of distillation is nearly or quite completed—the steam, in passing through the incandescent coke, being converted into water gas, and also removing from the coke further volatile matters; while the enriched water-gas passes into a retort (or portion of one) charged with coal.

Their proposal is for the retorts to be directly connected, and the areas of the heated surfaces in contact with the gas vapours reduced. By this arrangement, while no separate regenerator need be employed for the purpose, the sensible heat of the spent charge will be utilized for regenerative purposes; and the gases being passed direct into the adjacent retort, there is no need to employ a separately heated regenerator chamber to maintain their heat. Thus fuel is economized.

In applying the invention to coal distillation in intermittent vertical retorts, the connections between adjacent retorts are direct connections made within the heated setting without the use of valves. In existing settings where there is no direct connection between the bases of adjacent retorts, connection may be made by pipes between the mouthpieces. In inclined retorts where the off-take pipes are at the bottom, the steam would be admitted at the bottom mouthpiece of the retort which was in an advanced state of carbonization, and the water gas would pass off at the top of the retort, and thence be delivered to the tops of retorts containing coal, through which it would travel to the gas off-take at the bottom. The hot water gas, being rarefied as compared with the coal gas, floats along the crown of the retort, and thus reduces the contact of coal gas with the hot walls of the retort.

When intermittently charged retorts are charged with coal, the cold damp coal in contact with the retort walls has, it is said, a considerable cooling effect on the retort—the issuing products being coal gas laden with water vapour; so much so that the interior temperatures would be too low for properly carburetting the water gas with the coal gas. Usually these products escape into the hydraulic main; the vapours in the first rush being improperly fixed or "cracked" into permanent gases, so that the liquid yields are enhanced at the expense of the gas yield. Realizing these conditions, and also the great protective influence exercised by the water vapour towards the coal gas hydrocarbons, the patentees utilize the following features:

(*a*) By closing the outlet valve and delaying the steaming of the adjacent retort charge of coke, they allow the incandescence of the coke to be increased advantageously to the generation of water gas at a later stage. Thus the volumes in the first rush are reduced with advantage; the products leaving the coal in the present manner, except for the small volume of coke (hydrogen) gases entering the coal charge at high temperature.

(*b*) They may elect to close for a short period the off-take of the newly-charged retort and constrain the moisture-laden and protected coal gas coming first off the coal to pass up the adjacent coke-retort, wherein the moisture would (with the incandescent coke) form water gas, and the water gas would immediately be carburetted with the coal gas; so that degradation would not be set up, owing to the influence of the moisture content. This, however, is an old and well-known practice, and forms no part of the present invention.

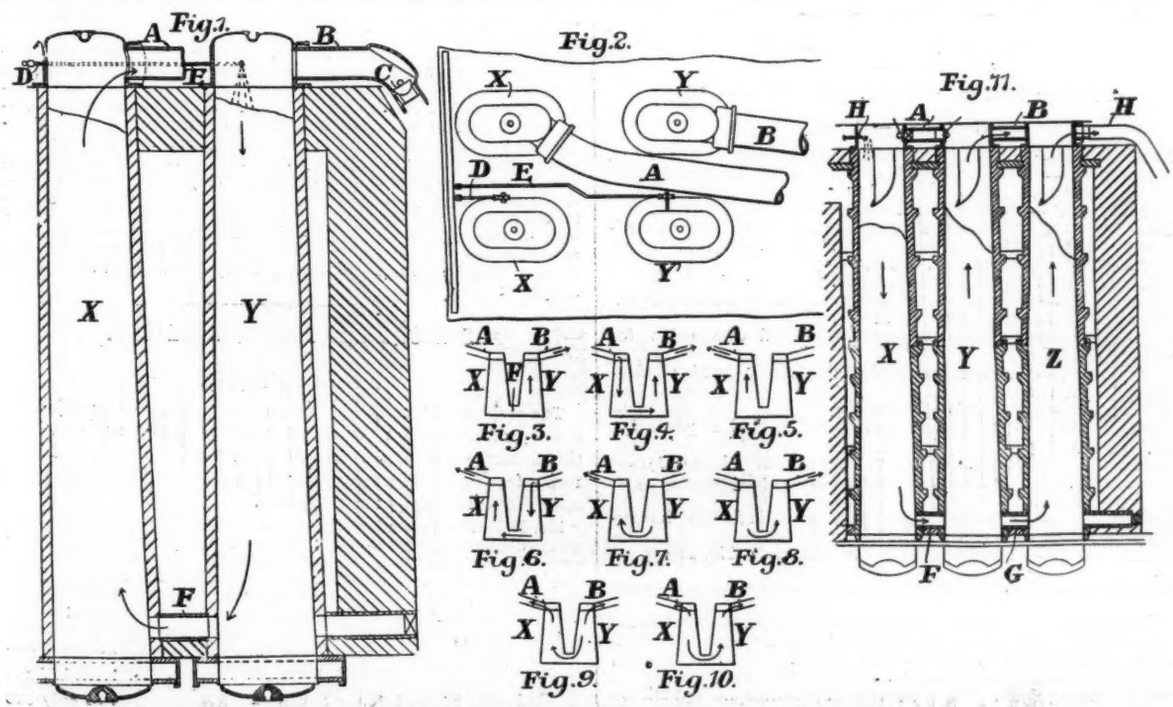
(*c*) In this early rush during the drying of the coal, they may delay the steaming only—thus permitting the rush of products to leave the coal-retort by the top gas off-take, and simultaneously by the adjacent and connected retort containing coke, and thus compound the advantages of (*a*) and (*b*). The process thus gives the carbonizer the choice of exercising his experience to suit his coals and requirements.

The coal being dried relatively becomes a non-conductor of heat; so that the retort temperature will rapidly recover, though the core of the charge will only gradually be heated. Steaming of the now brightly incandescent coke then commences; the rich and hot water gas passing immediately (and directly) into the coal-retort, where it both chemically and physically enhances the results by preventing the degradation of the hydrocarbons, preventing or reducing the deposit of scurf, preventing stopped pipes, speeding the exit of coal gas, and releasing imprisoned volatiles from the charge—especially from the core, and (moreover, being hot) will assist efficiently, by internal action, the heating of the core of the charge.

The spent and steamed coke having been discharged from the neighbouring retort, it is charged with coal. During the drying and warming of the coal as above, the coke in the first-named retort is permitted to saturate itself with heat, thereby raising its average temperature to bright incandescence—that is, a stage beyond the ordinary present-day straight coal-gas distillation practice.

The carbonized coal is now intimately steamed for the release of imprisoned volatiles, whereby additional coal gas is obtained—thus permitting of the admixture of more water gas. The steam also forms water gas—the action chemically and physically resulting in increased yields of gas, and thermal units in gas, tar, and ammonia.

In the diagrams are illustrated several examples of the practical application of the invention. Fig. 1 represents in vertical section, and fig. 2 in plan, vertical retorts connected to work in series of two. Figs. 3 to 10 illustrate the method of steaming a series of two vertical



Toogood's (Dempster & Sons) Coal Distillation Plant.

retorts. Fig. 11 represents in section vertical retorts connected to work in series of three.

Referring first to figs. 1 and 2, the retort X is assumed to contain relatively cold coal, and the retort Y to contain incandescent coke. A and B are the gas off-take pipes—the pipe B leading from the retort Y to the hydraulic main being temporarily closed by a ball valve at C. A steam-pipe D is connected to the retort X; and a steam-pipe E to the retort Y. The supply of steam through the pipe D is shut off, and the pipe E delivers steam (preferably superheated by waste heat, in accordance with patent No. 116,831) to the top of the incandescent coke in the retort Y. The gases evolved then take the course indicated by the arrows; the two retorts at their lower ends being in communication by way of the passage F.

Figs. 3 to 6 illustrate a method of working two retorts arranged as in figs. 1 and 2, during four consecutive periods of two or three hours each, or of other lengths of time found desirable. At the beginning of the first period (fig. 3) the retort X is full of hot coke, and the retort Y newly charged. During this period no steam is admitted; and the off-take A is closed. The gas from both retorts passes to the off-take, the coke in retort X becoming more intensely incandescent in preparation for steaming. In the second period (fig. 4), steam is passed through X and, by way of the passage F, into Y, and the blended gases evolved continue to pass off through the off-take B. This phase having been completed, the steam is shut off; the coke is discharged from the retort X, which is re-charged with coal; the off-take B closed; and the off-take A opened. During the third period (fig. 5), the conditions are the same as in the first period, except that the rôles of the two retorts are reversed; the coke in the retort Y being in an advanced state of carbonization, and its gases passing up the retort X to the off-take A. In the fourth period (fig. 6), steam is admitted to the retort by way of the top of retort Y, and the gases pass away by the off-take A.

The plant arranged as described is adaptable to various methods of working, some of which (being well-known practice) do not form any part of the present invention, and are merely described in order to indicate that the presence of facilities for carrying out the invention do not prevent the supervisor of the plant from using his own judgment as to methods of working in order to obtain the best results from the coals being carbonized at any particular time. For example, as in figs. 7 and 8, the off-takes A and B may be used alternately to carry off the gases from both retorts; the closed off-take being the one on the newly-charged retort for a short period before proceeding with the process according to figs. 3 to 6. Or as in figs. 9 and 10, in the first of which Y is assumed to be newly charged, and in fig. 10 X is assumed to be newly charged in turn when carbonization in Y is considerably advanced. In either case the gases from the new charge pass both upward and downward in the retort (as indicated by the arrows), so that both off-takes are used while the steam is shut off. This action is also only preliminary to proceeding with the process according to figs. 3 to 6. Referring to fig. 11, a third retort Z can be put in communication with the retort Y through another passage G. Assuming the retort X to contain incandescent coke, and the retorts Y and Z to contain coal, steam as admitted is further superheated in the space at the top of the retort X, which space during the charging of the retort is occupied by the charging shoot, which is, however, withdrawn before the present process begins. From the bottom of the retort hot water gas passes through the passage F to the retort Y, and from the retort Y, through the passage G, to the retort Z. Blended gas is taken away from the tops of both retorts Y and Z by the off-take pipes B and H; the off-take pipe A of the retort X being closed by plugs.

Horizontal and inclined retorts or ovens can similarly be grouped in series for the working of the process; the connections being either between the retorts side by side, or end to end, or between those above and below each other.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Sept. 17.]

Nos. 22,016—22,602.

ARCUS, C. R.—"Burners for liquid or gaseous fuels." No. 22,522.
ARCUS, C. R.—"Generator producing two fluids for generation of motive power." No. 22,523.
BRUMAN, O. F.—"Intermixing fluids, gases, &c." No. 22,286.
CHAPMAN, P. L.—"Apparatus for preventing loss of gas when feeding solids into liquids for generation of gas." No. 22,224.
DAVIS, H.—"Gas-stoves, &c." No. 22,557.
DEAM, O.—"Gland for gas-compressors." No. 22,463.
DEGUIDE, C.—"Complete extraction of naphthalene from gas obtained by distillation of coal." No. 22,544.
HOOD, J.—"Compression of gases by internal combustion for power." No. 22,301.
M'CREA, T. A.—"Process for desulphurizing sulphur-bearing hydrocarbons." No. 22,094.
MARBAIS, D.—See Deguide. No. 22,544.
MARKS, E. C. R.—"Wire-mesh globes, and method of producing same." No. 22,389.
SAFETY WIRE GAS-GLOBE COMPANY. See Marks. No. 22,389.
STANTON, W. W.—"Appliances for facilitating lighting of gas-burners." No. 22,567.
TAPPERT, R.—"Soldering-tools, &c., operating with bunsen burners." No. 22,279.
THOMAS, G. E.—"Treating peat, brown coal, &c." No. 22,054.

Glover-West Verticals for Montrose.—An order has been placed by the Montrose Gas Company with West's Gas Improvement Company for an installation of Glover-West vertical retorts. The work, which will be commenced next spring, will, it is estimated, increase the output by about 90 p.ct. The present maximum output is 52 million cubic feet per annum.

MISCELLANEOUS NEWS.

BELFAST GAS MANAGERSHIP.

A Special Meeting of the Belfast Corporation was held on Friday last (in committee) to deal with an urgent situation which had arisen in connection with the managership of the gas-works. The Engineer and Manager (Mr. J. D. Smith) was one of a limited selection by the Glasgow Corporation, out of a large number of applicants, for the position of Chief Gas Manager in that City. A deputation from the Glasgow Corporation had been active in Belfast during the week; and of the two in the final list, Mr. Smith, it appears, was the favourite.

This position led to a special meeting of the Gas Committee, at which it was decided to recommend that the Corporation should endeavour to retain Mr. Smith's services at an increased salary. Mr. Smith expressed his willingness to agree. The Committee meeting, having considered the recommendation, confirmed it, deciding to raise Mr. Smith's salary from £1430 (including war bonus) to £1750, rising in three years to £2000. This decision will come before the ordinary monthly meeting for ratification.

Mr. Smith, who was formerly in charge of the Stirling Gas-Works, was appointed Manager in Belfast ten years ago at a salary of £800. The Gas Committee and the Corporation have always very highly appreciated his skill, technical knowledge, and grasp of managerial detail; and it was felt that his leaving at the present time would have been a serious loss, in view of an important extension scheme on hand. The Glasgow Corporation adopted the course of asking applicants to state their own terms.

POTTERIES GAS-WORKS CENTRALIZATION SCHEME.

At a Special Meeting of the Stoke-on-Trent Town Council, held in private last Wednesday, it was decided to adopt a scheme of the Gas Engineer (Mr. Alex. Mackay) for the establishment of a central gas-works for the Potteries, and to enter into negotiations with the British Gas Light Company with a view to ascertaining the price at which they are prepared to agree to the acquisition of their undertaking by the Corporation.

It is understood, says the "Birmingham Post," that there was little opposition to the scheme, and that the resolution was carried by a big majority. At present there are several gas undertakings in the Potteries, four of which—Burslem, Stoke, Fenton, and Longton—are owned by the Stoke-on-Trent Corporation, and two at Hanley and Tunstall by the British Gas Light Company. The proposal is to centralize all the works, and to establish one big works in a convenient position in the Potteries.

PROPOSED NEW GAS-WORKS AT CARLISLE.

On behalf of the Ministry of Health, Mr. P. M. Crosthwaite last Tuesday held an inquiry into an application by the Carlisle City Council for sanction to borrow a sum of £250,000 for the erection of new gas-works.

Mr. W. Newbigging, Consulting Engineer to the Corporation, stated that the present gas-works were very congested, and the railway-siding quite inadequate. The coal storage accommodation was only one-sixth of the requirements. The storage of coke was also limited, and the method of handling it very primitive. As to the new works, he considered the site at Boustead's Grassing well suited for the purpose, and sufficient for future extensions. In his opinion the scheme was in accordance with the best modern practice. The present cost of manufacture in Carlisle was exorbitant in the extreme; and it was surprising that it should have gone on for so long. At the new works the saving would amount to at least 9d. per 1000 c.ft. The estimates had been prepared in great detail; but one could not tell what the prices might be next year. If the Ministry of Health could grant 45 years for the repayment of the loan, it would assist them; and then, together with the reduction they hoped to make in the cost of manufacture, they might see the price of gas at Carlisle very much cheaper than it was to-day. The new works could not possibly be ready until the winter of 1920-21.

SALFORD GAS PRICES INCREASED.

Demand for Inquiry.

The proposal to increase the price of gas came before an adjourned meeting of the Salford Borough Council on Wednesday last. The Gas Committee asked the Council to sanction an increase of 6d. per 1000 c.ft., and to reduce the amount of gas supplied by prepayment meters from 20 to 17·45 c.ft. per penny.

Mr. Delves said it was now proposed to make a charge for gas which would double the pre-war price; and he thought it was time for an inquiry into the working of the gas undertaking. He believed that there was considerable extravagance in connection with the gas-works; and he also complained of the quality of the gas supplied. Mr. Brotherton said they were getting tired of attacks on the Gas Committee; and he for one would welcome an inquiry. Many people seemed to forget that the cost of coal had increased by 200 p.ct., and that the demands of organized labour meant a great increase in wages. Mr. Royle denied that increased wages had anything to do with the question, and said he knew of one case where a foreman had charge of only two

workmen. An inquiry years ago into the working of the electricity undertaking had most beneficial results; and he thought a similar step should be taken with the gas undertaking, which was admittedly behind the times. Mr. Bescoby said that Salford had to maintain a certain standard quality of gas. This they did, with a little over. He had no hesitation in saying that Salford had one of the best gas engineers in the country. Mr. Greenwood said he was surprised at the light-hearted manner in which some of the members of the Council treated a subject that was of vital importance. If the suggested increase was not granted, Salford people would still be paying 2d. per 1000 c.ft. more than Manchester. Not far away they could manufacture gas at 6d. per 1000 c.ft. less than Salford.

Alderman Phillips, the Chairman of the Gas Committee, said it was dirty and cowardly to so attack an official who had not the chance to reply. Dealing with the reason for the increase, he said they were paying in bonuses £21,000; the increase of 6s. per ton for coal was equivalent to £30,000 or £40,000 per annum; rates were £5300; redemption charges, £1400; and materials other than coal, £6000. It was true that they obtained more for their bye-products; but this might not produce as much as £20,000. If members of the Council would make any definite charge, he would welcome an inquiry.

Eventually the recommendation was carried by 26 votes to 6.

EXPORTS OF CERTAIN COAL TAR PRODUCTS.

The Board of Trade (Export Licence Department) desire to draw attention to the fact that the export of coal tar and derivatives thereof (except solvent naphtha, cresylic acid, and mixtures containing cresylic acid) suitable for use in the manufacture of dyes and explosives, whether obtained from coal tar or other sources, and mixtures and preparations containing such products or derivatives, is still prohibited to all destinations.

Certain coal tar products, such as naphthalene and its derivatives, toluol and its derivatives, picric acid, xylol and its derivatives, carbolic acid crystals, anthracene oil, benzol and its derivatives, cresols (ortho, para, and meta), and their derivatives, were originally mentioned by name in the British list of prohibited exports; but these prohibitions have now been merged in the inclusive prohibition on the export of coal-tar products.

The export of naphthalene, foluol, picric acid, and the other coal-tar products above-mentioned, should therefore be regarded as prohibited to all destinations; and applications for licences to export them should be addressed in the usual way to the Controller, Export Licence Department, No. 1, Queen Anne's Gate Buildings, Westminster, S.W.

Included in a published list of goods in respect of which the export prohibition has been withdrawn is spent gas purifying material.

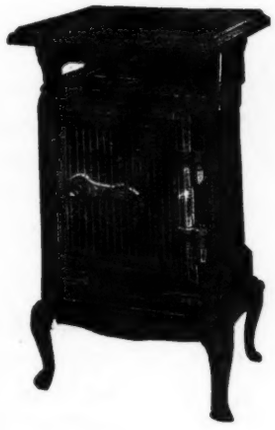
THE JAMES WATT CENTENARY CELEBRATIONS.

There was in Birmingham last week a large and distinguished gathering of scientists and engineers to take part in the James Watt centenary celebrations. At the inauguration of the formal proceedings, on Tuesday morning, by the Lord Mayor of Birmingham (Sir David Brooks), attention was drawn to the proposal to establish at the Birmingham University a James Watt Chair of Engineering. Speaking on the subject of "James Watt and Invention," Prof. H. S. Hele-Shaw suggested that it should be a Chair of Invention. Supplementary to this proposal, it is hoped sufficient money will be forthcoming to build a museum in which the relics of Watt, Boulton, and Murdoch may be fittingly housed.

The LORD MAYOR, extending a hearty welcome to those present, said they were very proud to number among them direct descendants of James Watt and Matthew Boulton. James Watt was not born in Birmingham. But he lived the greater part of his life there; and it was at Soho and Handsworth where his great inventive genius had its full scope, and where he applied himself to the solution of the great problems of his age. It was fitting that Birmingham, which owed so much to the inventions and discoveries of James Watt, should establish something in the nature of a permanent memorial to mark their appreciation of the great man and the work which he accomplished. The city had considered what form the memorial should take; and he thought the proposals which were made would commend themselves, not only to Birmingham citizens, but to all who appreciated the work that James Watt and his associates had accomplished. It was proposed to endow a Professorship of Engineering, to be known as the "James Watt Chair," at Birmingham University, for the promotion of research in the fundamental principles underlying the production of power. They wanted, if it was possible, to give opportunities to young scientific men to follow out the same line as that which was pursued with such great success by men like James Watt; and this was only to be accomplished by giving them the requisite facilities for training and for patient and quiet investigation. He hoped that part of the scheme which was proposed—the most important part of it—would be early placed beyond any doubt as regarded its success. It was very desirable that, in addition to the professorship at the University, they should erect in the City of Birmingham some building which might be used for housing the examples of the work of James Watt and the relics which he, Boulton, and Murdoch had left behind. There was a very interesting collection in the Free Library, which was presented by Mr. George Tangye. If they could erect buildings which should serve as a museum, and might also be used for a meeting-place for scientific and technical bodies, and be a centre for engineers, they would in this way have an admirable memorial to the work of these great men.

Prof. F. W. Burstall delivered a lecture on the "Rise of Engineering Manufacture;" and then an address was presented from the Norwegian

Gas and the Housing Problem.



PENDING the necessary provision of new houses, the best has to be made of existing accommodation. The essential economy of space is secured by the use of the ideal Cookers in present circumstances — Main's "Kent," "Sussex" and "Surrey." These efficient and compact cookers embody all recent improvements and are designed with a view to securing the minimum cost for maintenance.

R. & A. MAIN, LTD.

WORKS: Gothic Works, EDMONTON, N.18; Gothic Ironworks, FALKIRK; and Gothic Works, BIRMINGHAM.
SHOW-ROOMS AND BRANCHES: 25, Princes Street, Oxford Circus, W. 1; 82, Gordon Street, GLASGOW; 18, Severn Street, Deansgate, MANCHESTER; 97, Millfield, BELFAST; 333, Queen Street, MELBOURNE.

Government to the James Watt Centenary Committee, "as a token of the veneration felt in Norway for the memory of James Watt."

At Heathfield Hall, where Watt lived for many years, there was a garden party, by permission of Mr. George Tangye, the present owner. In connection with the celebrations, some honorary degrees were bestowed by the Birmingham University; the recipients including Sir George Beilby and Mr. F. W. Lanchester.

On Wednesday, there was a Commemoration Dinner, at which Sir Oliver Lodge and Mr. Austen Chamberlain were among the speakers. The Lord Mayor, replying to the toast of "The City of Birmingham," which was proposed by the American Ambassador, said it was a remarkable fact that, in celebrating the hundredth anniversary of James Watt's death, they were also celebrating the hundredth anniversary of the lighting of the streets of Birmingham by gas instead of oil. Prof. Rateau said he had been delegated by the French Académie and by the Société d'Encouragement de l'Industrie Nationale especially to bring to them at the Watt Commemoration a tribute of appreciation of science and labour in France to the memory of the great man in whose honour they were met that day.

Earlier in the day, Sir Oliver Lodge discussed the commercial future of radium, in a lecture on "Sources of Energy." Sir Oliver remarked that the discovery of radium excited universal interest and aroused very great surprise, because radium appeared to give off energy continually without being consumed. The truth was that it did disappear as it gave off its energy; but the disappearance was so slow, and the energy given off so remarkable, that it was not surprising that one was noticed before the other. The energy of radium, however, was not under any control; and it went on emitting energy at its own proper rate without regard to accidental circumstances. What happened was that every now and then a particle was projected. The energy stored in an atom was something enormous; and if one could make the atoms fly off when wanted, there would be available a source of energy which put everything else into the background. This energy was contained in all forms of matter, and was not confined to radio-active substances. If a stimulus could be found, the utilization of this source of energy would be possible.

There was also a paper by Prof. J. D. Cormack, who said: "There was nothing of chance in Watt's inventions. He made his great inventions by reasoning, founded upon the knowledge of the laws of Nature that he had acquired during a long course of study and experiment. He was even in the early days of his life a man of science. Though he was never in the nominal sense a student at the University, he had studied natural philosophy in many branches. He possessed sound and extensive knowledge of the science of his time, and was imbued with the true scientific spirit. His friend Prof. Robison says of him: 'Everything became to him a subject of new and serious study. Everything became science in his hands.' No words could more clearly describe his temperament, or more fully indicate the secret of his success and the reason of the pre-eminence—one might say finality—of much of the work he accomplished."

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 22.

Pitch continues in a healthy state; there being a considerable amount of inquiry. The price is firm at well over 75s. per ton net at makers' works. Creosote is steady at from 5½d. to 6d. per gallon. Solvent naphtha is in demand, and supplies are scarce. The price is firm at from 2s. 4½d. to 2s. 6d. per gallon. In other products there is nothing fresh to report.

Sulphate of ammonia remains unaltered.

Tar Products in the Provinces.

Sept. 22.

The average values for gas-works products during the week were: Gas-works coal tar, 37s. 3d. to 42s. 3d. Pitch, East Coast, 66s. to 67s. 6d. per ton f.a.s.; West Coast—Manchester, 55s. to 57s. 6d.; Liverpool, 55s. to 57s. 6d., Clyde, 65s. to 70s. nominal. Benzol 90 p.ct., North, 1s. 8d. to 1s. 10d.; crude 65 p.c. at 120° C., 11½d. to 1s. 0½d. naked at makers' works; 50-90 p.ct. naked, North, 1s. 8d. to 1s. 10d. Toluol, naked, North, 2s. to 2s. 1d. nominal. Coal tar crude naphtha in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 2s. to 2s. 2d. Heavy naphtha, North, 2s. 1d. to 2s. 3d. Creosote, in bulk, North, liquid, 5d. to 5½d.; salty, 4½d. to 4⅝d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct., 1s. 6d. to 1s. 6½d. Naphthalene, £15 to £17 10s.; salts, £4 10s. to £6, bags included. Anthracene, "A" quality, 7½d. to 7⅝d. per minimum 40 p.ct.; "B" quality nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

There is very little alteration in the conditions of the tar products markets, and prices generally are firm without much material change. Supplies still remain short, but are improving, and should reach normal conditions within the next two or three weeks. Pitch is probably the strongest feature, and has advanced further both in London and in Provincial centres. Sellers are not very anxious to part with stock, even at present rates, anticipating higher values in a short time. The fall in the exchange with France is causing much uneasiness in some quarters, as it is thought that this may hinder Continental sales and so affect the market here. There is nothing fresh in crude tars; but some inquiries have come to hand for naphthalenes which need elucidation. Prices asked, however, did not meet buyers' views, as no actual business is reported. If buyers are really serious, they will need to come nearer the present range of values, which are low compared

USE Simmance's
DEAD BEAT INDICATORS
instead of WATER-TUBE GAUGES and
"READ THE PRESSURE BY THE POINTER."

No liquid to evaporate and no levels to adjust.

No glasses to break and nothing to clean.

Direct reading, Open scale, Any range (Pressure, Vacuum, or Combination).

Incorrodible, Accurate, for foul or purified gas.

MADE IN MANY RANGES WITH TABLETS LETTERED AS DESIRED.

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER.

Agents: Australia—FYVIE & STEWART, 360, Collins St., Melbourne; Canada—W. P. ROPER, 502, Merchants' Bank Building, Montreal.

with the general run of bye-product values. There is practically no change in creosote and cresylic acid; but the demand for crystal carbolic acid seems to have dried-up suddenly, for which no adequate explanation is forthcoming. The market has naturally become practically stagnant; but so far quotations, both of crude and crystals, have not altered. There is nothing fresh in benzols, although it is said that the Association are preparing an extensive propaganda for the near future. There is really no question of the superiority of benzol to petrol; while the latest news from America does not suggest any great competition of petrol just yet. Solvent naphtha is very firm, particularly in Provincial centres, where there is rather a scarcity for the time being. Other products are without change.

The range of quotations is as follows:

Benzol: 90% London 2s. to 2s. 2d., North 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 9½d. North; crude, 60-65% 1s. 5d. to 1s. 7d.; pure, 3s. per gallon naked.

Carbolic Acid: Crude 60's 2s. per gallon nominal; crystals, 40%, 10d. per lb. asked.

Crude Tar: London, 47s. to 50s.; Midlands, 44s. to 46s.; North, 44s. 6d. per ton *ex* works.

Pitch: London, 77s. 6d. to 82s. 6d. per ton; East Coast, 70s. to 75s. per ton; West Coast, 67s. 6d. to 72s. 6d., with Manchester 70s. per ton and Glasgow 72s. per ton; South Wales, 64s. to 68s. per ton.

Solvent Naphtha: London, 2s. 5d. Provinces average 2s. 3d. per gallon.

Crude Naphtha: Naked, 10d. per gallon.

Heavy Naphtha: 2s. 5d. per gallon.

Naphthalene: Refined, £16 to £18 per ton nominal; crude, £5 10s. to £11, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North, 2s. 7d.

Creosote: London, 7¼d.; North, 5¾d. to 6¼d.; heavy oil, 6d. per gallon in bulk.

Anthracene: 40-45%, 7d. to 7½d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 2d. per lb.

Cresylic Acid: 95%, 2s. 4d. to 2s. 5d.; 97-99%, 2s. 7d. to 2s. 8d. *ex* works London, f.o.b. other ports.

Sulphate of Ammonia.

The position of sulphate remains unchanged, and supplies are still short. Nevertheless a few export deals have been arranged through the Association. With prices for home users fixed for some months ahead, the export trade seems to be the only thing that matters at the moment. But with supplies very short, and a strong and regular agricultural demand and home prices upon a more profitable basis, more and more interest will be taken in this side of the trade.

In the United States, a fairly extensive export business is reported of late, and prices are again a trifle higher than when I last wrote on the position there.

Crediton Urban Council and the Gas Company.

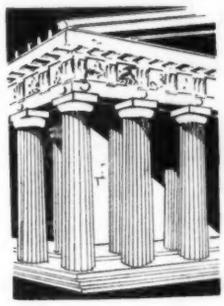
The action of the *Crediton Urban District Council v. Crediton Gas Company* [*ante*, p. 629] was in the list for hearing before Mr. Justice Greer, as Vacation Judge, last Wednesday. The plaintiffs claimed an injunction restraining defendants from ceasing to supply the Council with gas. When the case was called, Counsel stated that the parties had come to terms, and the Court would not be troubled with the motion. The defendants had agreed to continue to light the town as heretofore with gas until the trial of the action; and there would be no order on the motion, except that the costs be costs in the cause.

Price Increased at Brentford.—The Brentford Gas Company have given notice that the price of gas is to be increased after this month by 10d. per 1000 c.ft., making the charge 4s. 10d.

Gas-Works Finance at Bollington.—A recommendation of the Gas Committee of the Bollington Urban District Council to increase the price of gas came before the monthly meeting of the Council last Wednesday. One of the members, in moving an amendment that the recommendation be referred back for further consideration, submitted that a great deal of the money earned as profit by the gas department was being diverted from its legitimate purpose into the channels of the Council's general establishment charges and the part payment of the salaries of officials who had little or nothing to do with the gas department as a trading business concern. After a lengthy discussion, the minutes of the Gas Committee were adopted, on the understanding that the General Purposes Committee at an early date should go into the whole question of the gas undertaking.

Public Lighting in the Metropolis.—From all quarters among Metropolitan Lighting Authorities there comes evidence that "Lights Up" is the order—either now or upon the expiration of "Summer Time"—not only as regards the restoration of the lamps that have been out of lighting for so long, but in the matter of replacement of the burners, mantles, &c., of the lamps that have been in lighting at half the contract rate. Existing burners in use at a reduced candle power are to give place to burners giving the illumination customary before the war. So far the only difference in the public lighting now and before the signing of the armistice is the unmasking of the lamps. The illumination was there before; but it was concealed. Included in the metropolitan authorities who have already effected, or are about to effect, the much-needed change in lighting conditions to bring the streets up to their pre-war condition, or near to it, are Holborn, Finsbury, Stepney, and the City of London north of the Thames; while Greenwich, Deptford, Lewisham, and Camberwell on the south are following suit. It is understood that the remainder of the boroughs will be falling into line at the beginning of next month. Thus the Metropolis will once again enjoy the benefit of good lighting—not only in the main roads, but also in the subsidiary thoroughfares.

ARCHITECTURE
IN THE SERVICE OF
GAS



¶ For the planning and construction of an efficient and attractive Gas Showroom no concern is better equipped than the Architectural Decorations Department of the Nautilus Fire Co., Ltd.

¶ For the Architectural Decorations Department is under the charge of an experienced Architect, whose interests are those of GAS, and whose professional experience enables him, in the planning of Gas Showrooms, to display all the most attractive features of gas appliances without sacrifice of Architectural purity of style.

¶ Estimates and schemes are prepared, free of cost, on application to;—

Major F. Cornelius-Wheeler,
Manager, Architectural Decorations Dept.,
The NAUTILUS FIRE Co., Ltd.
(Proprietors: THE DAVIS GAS STOVE CO., LTD.)
60, Oxford Street, London, W. 1.

Westminster Technical Institute Classes.

The Principal (Mr. J. Stuart Ker, B.Sc.), in forwarding a copy of the prospectus of evening courses of instruction at the Westminster Technical Institute of the London County Council, draws attention to the fact that the classes will re-open during this week, when all intending students should be present to enrol. There are classes on gas-fitting and supply (Mr. P. Smithers and Mr. D. J. Winslow), gas-fitting workshop practice (Mr. P. Smithers, Mr. H. S. Tutton, and assistants), and gas supply and gas engineering and manufacture (Mr. A. Meade). Courses for gas-fitter apprentices are given by Mr. F. G. Steed, Mr. Smithers, and Mr. T. G. Ferne. Particulars are given of group courses which students engaged in the gas industry are strongly recommended to follow out. Arrangements have again been made for the London and Southern District Junior Gas Association to hold their meetings at the Institute.

Strike at Carrickfergus.—Great inconvenience was caused in Carrickfergus (co. Antrim), owing to a strike of gas-works' employees on a wages and hours question. Negotiations were opened with the men through their Union; and ultimately satisfactory terms were arranged, and work was resumed.

Cork Gas-Workers' Dispute.—A mass meeting of members of the Cork Gas-Workers Union was held to consider the recommendation of the local Conciliation Board in the recent demand on the Gas Company in regard to hours and employment conditions. After discussion, the men accepted the Board's recommendations.

Price of Gas at Bath.—Notifying to the consumers an increase of 3d. per 1000 c.ft. in the price of gas, Mr. W. Blundell, the Secretary of the Bath Gas Light Company, points out that, "owing to the great increase in the price of coal and all other materials, and the uncertainty of the present markets, this increase must not necessarily be regarded as final." The rental rates of meters and stoves is increased by one-third.

Gas Coal Stocks.—The "Iron and Coal Trades Review" says: The position of reserves of gas concerns, particularly in the Midland and Southern counties, is far worse than in June, when many had stocks equal to four weeks' winter requirements. Now, however, they are at very low levels in many cases; and it seems impossible to materially increase their reserves this side of winter. If towards the end of the year, the shortage of gas fuel becomes really acute, it is quite likely that for a short time the bulk of production of suitable fuel will be consigned to gas concerns in order to provide an ample working margin. If the necessity for such a process arises, deliveries to householders would be restricted to a small weekly supply. These would be drawn from merchants' reserves, or those held under the supervision of Local Fuel Overseers, unless, of course, the latter are to form a special reserve which will only be utilized in the event of industrial trouble.

City Corporation and the Price of Gas.—The City Corporation have decided not to oppose the increase of the Gas Light and Coke Company in the price of gas to 4s. 8d. per 1000 c.ft., but to suggest to the Board of Trade, in the interests of consumers, certain conditions which they consider should be incorporated in any Order which the Board may make in the matter.

Newtownards Gas-Works Extensions.—The Newtownards (co. Down) Urban Council considered plans and estimates submitted by the Gas Manager (Mr. R. Scott) for an extension scheme and mains. It was resolved to apply to the Local Government Board for Ireland for a loan to enable the work to be proceeded with.

Price of Gas at Navan.—The Gas Company having intimated to the Navan (co. Meath) Urban Council that they could not supply gas at less than 12s. 6d. per 1000 c.ft., several members protested that the price was too high, while others suggested that the electric light should be installed. Mr. J. Keappock said the Council could not afford so much, and thought they would be well advised to ask the Gas Company for concessions on behalf of the large consumers. This appeared to be all they could do in present circumstances.

Pleno Limited.—A Company bearing the title of Pleno Limited has been registered with a capital of £100,000, in £1 shares. Among the objects stated are to purchase or otherwise acquire any interests in any patents, &c., conferring a right to use, &c., any invention in relation to the effecting of economy in the manufacture, distribution, and application of gas; to carry on businesses of general gas engineers and contractors, electricians, electrical engineers, manufacturers and suppliers of gas plants, laying of mains, and any other businesses (including that of printers, publishers, and newspaper proprietors); and to promote companies. The first Directors are Mr. George Helps and Mr. F. C. Caldicott; and the Secretary is Mr. A. S. Clark, with offices in Queen's Buildings, Queen's Road, Nuneaton.

High Price of Coal at Lewes.—The Directors' report for the half year ended June 30, which was adopted at the meeting of the Lewes Gas Company, stated that the revenue account showed a profit of £1391. After providing for income-tax and interest on mortgages, &c., the balance of net revenue was £1495, and it was recommended that dividends for the six months be declared at the rate of 5 p.ct. per annum on the original stock, and 3½ p.ct. upon the additional stock. These would amount to £519. The Chairman (Alderman J. Miles) said that before the war gas was 3s. 6d. per 1000 c.ft. Now it was 6s.—a rise of 72 p.ct., while wages generally had gone up over 100 p.ct. Mr. Monk remarked that when they could again use the port of Newhaven, and when the many restrictions and Government interference were removed, a brighter day would dawn for the shareholders. Through the orders of the Coal Controller, though they had several thousand tons of Yorkshire coal under contract at 23s. 6d. a ton, they had had to buy seaborne coal of inferior quality at 47s. 6½d. per ton delivered at Lewes station. In July they had had to buy similarly inferior coal at 50s. 6½d. a ton—161 p.ct. over their pre-war rate.

"PIONEERS" OF BLUE WATER GAS
FOR "JOINT USE" WITH COAL GAS.

DEMPSTER'S COMBINATION OF

C-W-G- AND
BLUE WATER GAS

APPARATUS "IS NECESSARY."

R. & J. DEMPSTER, LTD.,
MANCHESTER.

Temporary London Office:
BLENHEIM MANSIONS,
BROADWAY, WESTMINSTER, S.W.1.
London Office Telephone No. Vic. 7496.

Maximum Price at Hexham.—The Hexham Urban District Council have decided to oppose an application by the Gas Company for authority to increase the price of gas.

Antwerp Gas Strike Ended.—The strike of gas workers at Antwerp, to which reference was made in the last issue of the "JOURNAL," may, a telegram from Antwerp states, now be regarded as settled.

Offer of Gas-Works at Bervie.—The Bervie Town Council have considered at a special meeting offers by the Gas Company to let the gas-works or to sell them. It was agreed to consult an expert upon the question.

More Coke-Oven Gas for Sheffield.—The Sheffield Gas Company, who for some time have been taking about 8,000,000 c.ft. of coke-oven gas weekly from the Tinsley Park Colliery Company, have now entered into an agreement with the United Steel Companies for a supply from their Orgreave Colliery.

Breakdown at New Mills.—The town and district of New Mills (Derbyshire) was in darkness last Wednesday night, owing to a breakdown at the gas-works, resulting in the stoppage of the passage of gas from the purifiers to the holder. Disley, which is supplied from New Mills, suffered similarly.

Exports of Chemicals from Norway.—The "Official Statistical Bulletin of Norway" for 1918 states that, among other exports, that of calcium carbide last year had dropped to 41,771,876 kilos. from 46,066,650 kilos. in 1917; while no sulphate of ammonia was exported, as against an amount of 50,000 kilos. in 1917.

Sunderland Gas Company and Municipalization.—In the new Act of the Sunderland Gas Company, the Corporation secured the insertion of a clause giving them power to promote a Bill in the next session of Parliament to acquire the concern. There is not, however, the "Yorkshire Post" says, much prospect of the undertaking being municipalized; for the Chairmen and Vice-Chairmen of Committees have by a large majority decided against the proposal.

Percentage Increases in Cost at Heywood.—In moving the adoption of the minutes of the Gas Committee of the Heywood Town Council, Alderman Healey said it had been decided to increase the price of gas 6d. per 1000 c.ft., bringing the charge to 5s., or 2s. 3d. more than the pre-war figure. The total increase was equal to 82 p.ct. During the war the cost of coal had increased by 140 p.ct., labour by 135 p.ct., and other materials by 150 p.ct. The resolution was agreed to.

Price of Gas at Hull.—The price of gas is being raised by the British Gas Light Company at Hull from 4s. to 4s. 6d. per 1000 c.ft. The Resident Engineer and Manager (Mr. Harold E. Copp) states that this is due to further advances in wages, reduced working hours, increased cost and inferior quality of the coal allocated to the Company, and extra cost of the conveyance of coal by sea. Meter rents and stove and fittings rents (not subject to hire-purchase contracts, or agreements for a definite period) will be increased 50 p.ct. as from Oct. 1.

Quality of Padiham Gas.—Mr. Wiggins, the Chairman of the Padiham Urban District Council, at a meeting last week said there had been several complaints about the quality of the gas; and these complaints seemed to reflect on the management. The British thermal units in Padiham gas used to be 600; but to-day the quality was from 520 to 550 B.Th.U. The standard recommended had been reduced to 470 B.Th.U. All public authorities were now working to lower units; and the poorer quality of gas applied not only to Padiham, but to other towns. The quality in Padiham was above the average. With incandescent appliances, kept in good order, it was claimed that as good a light as before could be obtained.

Price and Quality at Widnes.—The minutes of the Gas Committee, recommending an increased charge to consumers, came before the Widnes Town Council at their last meeting. Alderman Timmins said the advance (6d. per 1000 c.ft.) was necessary in order to enable them to pay their way; but there was some consolation in the fact that the charges for their gas were still the lowest in the country. Mr. Millar said that he appreciated the price of the gas being the lowest in the country; but what they wanted was an improvement in the quality. He suggested that the Committee should consider the abolition of meter-rentals and the installation of dry meters which, he contended, were more economical than wet meters. Alderman Timmins stated, regarding the abolition of meter-rents, that somebody had to pay for the meters; and if it were not done by way of rental, it would have to come out of the price of gas. The Committee would be glad to consider the proposal to instal dry meters, if they could be proved to be advantageous. The increase, to take effect from the beginning of the ensuing year, was agreed to.

In a wages dispute between the employees at the Skipton Gas-Works and the Gas Committee, the increases offered by the Committee were refused; and the matter has been referred to arbitration.

The Ministry of Health have acceded to the Southend Corporation's application for sanction to the borrowing of the sums of £320 and £1500 to meet the expenditure, in excess of the sums already sanctioned, in connection with the erection of a retort-house and retort-settings at the Leigh Gas-Works.

Decisions to instal "A. & M." patent pressure-wave automatic controllers in connection with their public gas-lamps have been arrived at by the Galston Town Council, the Blyth Urban District Council, the Peterborough Urban District Council, the Misterton Parish Council, and the Bolehall and Glascote Parish Council, Tamworth.

Owing to increasing business, Messrs. Clayton, Son, & Co., Ltd., of Hunslet, Leeds, have found their present London offices inadequate; and they have arranged to remove to more commodious premises at No. 5, Victoria Street, Westminster, where Mr. Harry S. While, their London agent of many years' standing, will continue to represent the firm.

Made in Three Heights.
26-in. 32-in. 39-in.

Your enquiries for the Winter Season's requirements are invited.

ARDEN HILL & CO.'S

"MARS" Gas-Heated - Steam - RADIATORS

are the most efficient and reliable gas-heating apparatus for large Buildings. Only a gas connection is needed and when lighted they work automatically, needing no attention. They are clean, convenient, silent, and economical, and will last a lifetime.

Full particulars will be posted on request.

ARDEN HILL & CO.,
"Acme" Works - Birmingham.

STOCK MARKET REPORT.

THE Stock Exchange has not had a brilliant week; being unable to shake off the dull tone which characterized the close of its predecessor, and which was now in for another five days' innings. This was attributable to more causes than one; but the chief factor probably was the increasing tightness of money and the problems arising out of the national financial position. Thus there was a wide disposition to restrict enterprise. Markets accordingly fell quiet, with prices on the downward slope.

The gilt-edged market felt the influence, and Home Government issues went down. The great incident of the week was the entry of the Funding Loan and the Victory Bonds into the market. Selling orders were conspicuous, and both issues closed a little below opening figures. The 5 p.ct. Loan and Consols moved similarly; the former touching 94⅝ and the latter 50 on Friday. Home Rails were weaker; but the closing prices were not the lowest of the week. Canadians were irregular; but Argentines were firm. The Foreign Market was dull. French fell badly, but made a remarkable recovery later. Russians were almost unsaleable in face of the Allies reported desertion, and most others were weak. Among the Miscellaneous group were some brighter spots. Oils were conspicuously active. Rubbers failed to attract support. Shipping and Iron and Steels were in demand, also Textiles and Breweries.

Business in the Gas Market almost beggars description, for there was hardly any to describe. It would seem bent upon making a new record for inactivity. Each day had but a mere handful of bargains; and on Friday the total number of recorded transactions was two. Probably would-be buyers and sellers are awaiting some clue as to what the Government will do with regard to the monstrous legislative injustice under which the industry groans. Movements were few and slight. Gas Light ordinary were rather firmer; but the maximum eased a point. South Metropolitan was steady. Commercial 4 p.ct. was easier. Croydon "B" and "C" were marked-down. South Shields had a smart rise. Imperial Continental was quiet and unchanged. Primitiva prices were a shade lower.

Bargains done for cash during the week were as follows: On Monday, Alliance and Dublin 45½, Gas Light ordinary 60, 60¼, 60½, 61, ditto maximum 48, 48½, ditto preference 66½, ditto debenture 52½, Imperial Continental 128½, 129, Monte Video 13, Primitiva 33s. 1½d. On Tuesday, Commercial 4 p.ct. 57, ditto 3½ p.ct. 54, European 12, Gas Light ordinary 60¼, 60⅜, Imperial Continental 127½, 127⅜, 128¼, 129, ditto debenture, 79½, Oriental 105⅜, South Metropolitan 61, ditto debenture 52, Plymouth 74⅝. On Wednesday, Brentford "A" 55, Commercial 4 p.ct. 58, Gas Light ordinary 60, 60¼, ditto maximum 47, ditto preference 65, ditto debenture 52⅜, Imperial Continental 128½, Primitiva preference 67s. 6d., South Metropolitan 60, 60⅜, 61, ditto debenture 52⅞, Brighton and Hove "B" preference 95. On Thursday, Brighton and Hove original 123, Bristol 79¼, Imperial Continental 127½, Oriental 104½, 105½, Primitiva 32s. 6d., ditto preference 66s. 3d., 67s. 6d., South Metropolitan 60½, 61. On Friday, Primitiva preference 66s. 3d., South Metropolitan 60½, Colonial Gas Association 5 p.ct. debenture 72.

In the Money Market, there was a continuous and increasing demand, in response to which quotations advanced materially. Discount rates hardened. The price of silver reached 62d. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices, July 28, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
182,049	Stk.	July 31	4	4%	Aldershot 4 p.c. Pref.	..	60—65	..
1,551,868	"	April 8	2½	2½%	Alliance & Dublin Ord.	59—54	45—55	45½
874,000	"	July 11	4	4%	Do. 4 p.c. Deb.	76—79	60—62	..
280,000	5	April 29	7½	8%	Bombay, Ltd.	57—63	53—61	..
50,000	10	Aug. 28	16	12%	Bourne- mouth Gas and Water { 10 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	20—30	19—20	..
888,110	10	"	7	7%		15—15½	10—11	..
115,000	10	"	6	6/-		13½—14	9½—9⅝	..
159,740	—	June 27	—	4%		..	65—67	..
992,045	Stk.	July 11	14	37/-	Brentford A Consolid.	261—266	55—60	55
784,920	"	"	11	31/8	Do. B New	204—209	50—55	..
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	76—78	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—98	64—66	..
214,775	"	Sept. 11	11	7½%	Brighton & Hove Orig.	208—218	123—128*	123
244,200	"	"	8	6⅛%	Do. A Ord. Stk.	154—159	84—85*	..
933,500	Stk.	—	5	5%	Bristol 5 p.c. max.	..	..	79½
580,000	20	Mar. 26	13½	10%	British	44—45	27—29	..
120,000	Stk.	June 27	4	4%	Do. 4 p.c. Deb. Stk.	88—90	63—65	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	50—53	..
100,000	10	—	—	—	CapeTown & Dis., Ltd.	1½—2½	6½—7	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7½	..
100,000	Stk.	June 27	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	61—66	..
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	..
1,518,280	"	Aug. 14	5/9/4	80/-	Commercial 4 p.c. Stk.	106—108	55—60	57—58
660,000	"	"	5½	26/8	Do. 3½ p.c. do.	103—105	54—57	54
475,000	"	June 11	8	8%	Do. 8 p.c. Deb. Stk.	69½—71½	50—52	..
800,000	"	"	4	—	Continental Union Ltd.	76—79	43—48	..
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	66—70	..
51,600	Stk.	Aug. 28	14½	12%	Croydon A 10 p.c.	..	150—160	..
278,400	—	"	11½	9%	Croydon B and C 7 p.c.	..	105—115	..
492,270	Stk.	—	6	6⅛%	Derby Con. Stk.	128—125	..	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	..	..
1,002,180	10	July 30	10	5/6	European, Ltd.	17½—18	12—14	12
16,298,975	Stk.	"	4/17/4	80/-	Gas { 4 p.c. Ord.	98—102	58—61	60—61
2,600,000	"	"	8½	26/8		76—79	47—49	47—48½
4,062,285	"	"	4	4%	Light { 3½ p.c. max. 4 p.c. Con. Pref.	96—99	65—66	65—66½
4,674,850	"	June 11	8	8%	and { 3 p.c. Con. Deb.	73½—74½	52—55	53½—52½
180,000	"	"	10	10%	Coke { 10 p.c. Bonds	..	..	..
82,500	"	Sept. 11	5	4⅜%	Hastings & St. L. 5 p.c.	..	57—62*	..
258,740	"	"	8½	2⅛%	Do. 3½ p.c	37—39	42—47*	..
70,000	10	April 29	11	7%	Hongkong & China, Ltd.	16½—16½	72—82	..
86,600	Stk.	Aug. 28	9	8⅛%	Hornsey 7 p.c.	..	110—115	..
181,000	"	Sept. 11	7½	6⅜%	Ilford A and C.	151—154	88—98*	..
85,780	"	"	6½	4⅜%	Do. B	115—118	67—72*	..
65,500	"	June 27	4	4%	Do. 4 p.c. Deb.	92—94	61—64	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	128—133	127½—129
1,325,000	"	Aug. 14	8½	8½%	Do. 5½ p.c. Deb. Red.	84—86	79—81	79½
285,242	"	Sept. 11	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	87—92*	..
2,498,906	"	Feb. 26	10	42/6	Liverpool 5 p.c. Ord. { A B	211—218 146—148	..	.. ..
806,088	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	..
165,736	"	Aug. 14	7/5/6	80/-	Maidstone 5 p.c.	..	56—61	..
75,000	5	June 11	5	5%	Malta & Mediterranean	4½—4¾	3½—3¾	..
250,000	100	April 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	91—98	..
541,220	20	May 29	4	5%	Monte Video, Ltd.	11½—12	12½—13½	13
1,275,593	Stk.	July 30	4½	3½%	Newcastle&Gateh'd Con.	98½—99½	64—65	..
532,705	"	June 27	8½	8½%	Do. 3½ p.c. Deb.	82—83	57—58	..
15,000	10	Sept. 11	—	11⅛%	North Middlesex 10 p.c.	..	13½—13½*	..
65,940	10	"	7/14/0	7½%	" " 7 p.c.	14—15	9—9½*	..
800,000	Stk.	May 14	6	6%	Oriental, Ltd.	117—122	103—106	104½—105½
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	4½—5½	..
60,000	50	Aug. 28	18	7½%	Portsea, Island B	128—131	74—76	..
100,000	50	"	12	6½%	Do. C	118—121	56—59	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	1½—2	33/6—33/1½
499,950	5	June 25	5	—	Do. 5 p.c. Pref.	4½—5	2½—3½	66/3—67/6
531,500	100	June 2	4	4%	Do. 4 p.c. Deb.	91—98	71—73	..
600,000	Stk.	July 30	4	4%	Do. " 1911	..	49—53	..
846,198	"	June 27	4	4%	River Plate 4 p.c. Deb.	86—87	49—52	..
150,000	10	May 14	6	6/-	San Paulo { 5 p.c. Pref. 6 p.c. Deb.	10½—11	7½—8	..
125,000	50	July 2	5	5%		4½—49	40—43	..
185,000	Stk.	Aug. 28	10	5%	Sheffield A	228—234	81—85	..
309,984	"	"	10	5%	Do. B	222—234	81—85	..
523,500	"	"	10	4⅜%	Do. C	220—221	70—72	..
188,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	..	..	..
90,000	10	June 27	9	10%	South African	10½—11½	12½—13½	..
5,609,895	Stk.	Aug. 14	5/4/0	80/-	South Met. 4 p.c. Ord.	111—113	59—62	60—61
250,000	"	July 11	—	5%	Do. Pref.	..	94—96	..
1,895,445	"	"	8	8%	Do. 3 p.c. Deb.	73½—74½	53—54	52—52⅞
224,890	"	Aug. 14	8½	5%	South Shields Con. Stk.	157—159	104—106	..
952,795	"	"	6	3⅜%	S'th Suburb'n Ord. 5 p.c.	114—116	68—78	..
197,558	Stk.	June 27	5	5%	Do. 5 p.c. Deb. Stk.	115—118	88—91	..
647,740	"	May 14	7½	8%	Southampton Ord.	99—102	62—68	..
121,275	"	June 27	4	4%	Do. 4 p.c. Deb. Stk.	..	63—65	..
120,000	"	Aug. 14		4½%	Tottenham { A 5 p.c.	135—138	70—75	..
782,275	"	"	6	3%	District { B 3½ p.c.	115—117	50—55	..
181,355	"	June 26	4	4%	4 p.c. Deb.	87—89	64—66	..
182,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	..
286,476	Stk.	Sept. 11	5	5%	Tynemouth 5 p.c. max.	108½—109	80½—82½*	..
80,000	"	Aug. 28	8⅜	55/-	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	85—90	..
255,686	"	"	6¼	40/-	Do. B 3½ p.c.	129—134	63—68	..
108,075	"	"	—	38/6	Do. C	..	63—68	..
140,865	"	"	—	38/6	New Ordinary	..	63—68	..
852,000	"	"	6⅓	38/9	Wimbledon 5 p.c.	117—122	65—70	..
98,000	"	"	6⅔	40/-	Epsom 5 p.c.	121—126	65—70	..
83,416	"	June 27	3	3%	3 p.c. Deb. Stk.	66—69	49—51	..

* Ex Div.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under (about 40 words) 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

		ONE YEAR.	HALF-YEAR.	QUARTER.
United Kingdom	Advance Rate:	28/-	15/-	8/8
	Credit Rate:	32/-	16/-	9/6
Abroad (in the Postal Union) Payable in Advance		32/6	17/-	10/-

In payment of subscriptions for "JOURNALS" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.